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International Abstract of Surgery

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—Journal A. M. A., January 1, 1921, page 33.

"WHEN we consider the use of mixed vaccines, we find at once more valuable and more enthusiastic reports as regards their preventative value. * * * * *

"Mixed vaccines have been used, not only preceding exposure to influenza, but also during the course of the disease in the hope of preventing its complications. There is a steadily growing body of information, * * * * * that would seem to indicate that a mixed vaccine containing streptococcus and pneumococcus in addition to influenza bacilli will notably decrease the pneumonic complications of influenza." * * * * *

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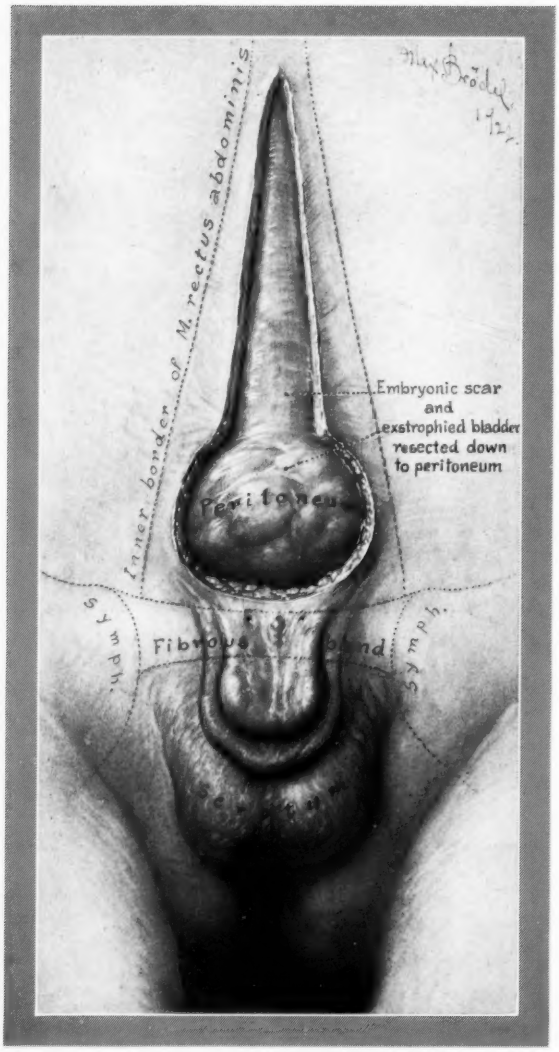

Fig. 9. Excision of rudimentary bladder and scar tissue. Circular area in the lower part of the incision represents the area from which the bladder was removed. The upper portion, the area from which embryonic scar tissue was removed. Dotted lines represent the inner borders of the recti abdominis muscles, and also the fibrous band and ends of rami of the symphysis.

Exstrophy of Bladder with Successful Transplantation of Ureters into Rectum. —*E. H. Hutchins and A. F. Hutchins*

SURGERY, GYNECOLOGY AND OBSTETRICS

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EXSTROPHY OF BLADDER WITH SUCCESSFUL TRANSPLANTATION OF URETERS INTO RECTUM

REPORT OF TWO CASES

BY E. H. HUTCHINS, M.D., F.A.C.S., AND A. F. HUTCHINS, M.D., F.A.C.S., BALTIMORE

IT would be difficult, indeed, to find a more pathetic disease or deformity, with its accompanying disturbance of the generative organs, than that of exstrophy of the bladder. In addition to the physical pain and inconvenience to which he is subjected, if the condition be allowed to remain uncorrected, the victim, a worse than sexless being, is tolerated only as an unwelcome member of society and remains doomed to social and economic isolation.

According to Neudoerfer (1), this abnormality occurs once in 50,000 persons, and according to Spooner (2), who combined the statistics of Henow, Sickel and Winckel, four times in 116,500 birth records. The ratio in which it occurs in boys and girls is about eight to one. Marion (3), however, has pointed out that nature seems to be kind to sufferers from this deformity, for Berger, according to Orlow (4), states that of 74 children born with exstrophy only 23 passed the twentieth year of life, the others dying of pyelonephritis and other kidney complications.

As to the etiology of this deformity, there are various theories. Bon and Duncan (5) adopted an entirely mechanical view, holding that the deformity is caused by complete rupture of the fetal bladder, from overdistention. Velpeau (6) considered it to be due to ulceration of the abdominal walls and bladder, between the second and third months of intrauterine life, when the tissues are very thin. Vrolik (7) advanced the theory that the deformity arises from an arrest in the development of the bladder and urachus from the fetal allantois. Variation in the specific gravity of the amniotic fluid has been assumed as the cause. These, however, are merely theories, which it would be somewhat difficult to prove or disprove.

Defects often associated with this condition are epispadias, in the male; the pubic arch is incomplete anteriorly; the transverse rami of the symphysis pubis may be several inches apart; the umbilicus is lower than normally; the pelvis broader, flatter, and the femora turned outward, so that in many cases the patient has a waddling gait. Ventral and inguinal hernias, spina bifida, and harelip are also occasionally found. So far as we have been able to gather, the prostate, the seminal vesicles, and the testicles are always present.

We were unable to find in the records any report of procreation in the male. In the female, Winslow (8) reported the case of a woman who had had four children. Moorehead (9) reported a case in a woman who had borne two children.

The terminal result in exstrophy of the bladder, in untreated cases, as a rule, is death from pyelitis, pyonephrosis, and hydronephrosis.

According to Sweet and Stewart (10), a fact which Sampson thought he had also demonstrated, infection does not extend from the bladder to the kidney along the ureters, but along the lymphatics surrounding the ureters to the kidney pelvis. In support of this view, they cite Sugimura's observations in 21 autopsies that the walls of the lower part of the ureters are nearly always involved in acute cystitis, whereas there is only a slight amount of inflammation in the mucosa.

About 1851, exstrophy of the bladder with its accompanying deformities began to be looked upon differently, and sufferers who had survived childhood were given an opportunity to benefit by surgical interference.

Flagani (11) about this time described a case in a person of 70 years, and later reported two cases in patients 26 and 49 years old, respectively. In 1851, Simon (12) transplanted the ureters into the intestine, and so far as we have been able to learn, this was the first attempt to divert urine into the rectum. The operation proved unsuccessful.

Roux (13), in 1852, developed a plastic operation for the purpose of constructing a bladder on the abdominal wall. Modifications of this method were introduced by Nélaton (14), in 1854. These also were unsuccessful.

The first successful plastic operations for exstrophy were done by Ayres (15) and by Pancoast (16), in 1858. Wood (17), in 1869, reported eight cases. No attempt was made by these surgeons to control the urine, their idea being to form a pouch to which an apparatus could be applied, so that the patient might be saved the humiliation of having his clothes saturated constantly with urine. There are many objections to this method. Several operations are usually necessary even to form a pouch, and all of them expose the patients to great risks. Moreover, it is impossible to keep the pouch clean, because of the pubic hairs and lime deposits.

Trendelenburg (18), made a partial separation of the sacro-iliac joint, and attempted an approximation of the pubic arches over the bladder.

Koenig (19) and others made subcutaneous sections of the bony arches to aid in the development of the bladder. The mortality was about 30 per cent in these cases.

Incontinence is the bugbear of these patients and any method that fails to remedy this defect will never prove successful. From a review of the literature and actual observation, it is quite apparent that the only way to eliminate incontinence is by transplanting the ureters into the intestine either intraperitoneally or extraperitoneally.

Thomas Smith (20), in 1891, transplanted both ureters into the rectum, extraperitoneally. In the same year Kuester (21) did a similar operation after removal of a bladder for cancer. Chaput, in 1892, transplanted one ureter into the rectum for the cure of a ureterovaginal fistula. The patient lived 9 years.

So far as we can find from the literature, Chalot (22) was the first to do a successful bilateral transplantation of the ureters, following removal of the bladder for cancer. This operation was done in 1890.

Reginald Harrison (23), in 1897, showed a patient who had suffered from exstrophy, upon whom he had done a left nephrectomy and transplantation of the right ureter through the loin. On being asked why he had removed one kidney, he replied that it would have been extremely difficult to collect the secretion satisfactorily from both sides.

Numerous other methods have been devised, but the two which have become most popular, and which have given the best results, are ureteral transplantation into the intestine, intraperitoneally or extraperitoneally.

Simon, in 1852, connected the previously closed bladder with the rectum by making a ureterorectal fistula. Fowler (24), in 1898, did the valve type of operation.

Diakonow (25), in 1908, drew a strip of bladder through a space tunnelled between the sphincter ani and the rectal mucosa, so that the anal sphincter closed the new urethra as well as the anus.

Gersuny (26), in 1898, separated a loop of ileum and, after re-establishing the continuity of the intestine, brought one end of the loop down through a tunnel made within the anal ring, and at a second operation transplanted the base of the bladder into the upper end of the short segment of bowel intraperitoneally.

Verhoogen (27), in 1908, divided the ascending colon and the ileum near the ileocæcal valve, after which he closed the four ends and completed the intestinal canal by a union of the transverse colon and ileum. The appendix was drawn through a perforation in the abdominal wall and catheters were passed into the opening for irrigating the cæcum. Later the base of the bladder, with the ureter intact, was united with the cæcum and emptied of urine at regular intervals by means of a catheter. Both patients died.

Maydl (28) was the first surgeon to transplant successfully the trigone with ureters intact, intraperitoneally. Moynihan (29) did the same operation, extraperitoneally, in one successful case. Bergenhem (30), in 1894, was the first to succeed in transplanting the ureters into the rectum, extraperitoneally. The two methods go by their names. In America and Great Britain, credit goes to Peters (31), who practiced the procedure and published an account of it without the knowledge of Bergenhem's work. In Italy it is known as Pozza's (32) operation. According to Buchanan (33), the immediate mortality in Maydl's operation is 28.7 per cent. Of 57 patients who recovered, 65 per cent have lived 1 year, 24 per cent over 5 years. To this number, if we add Stevens' list of 16 cases (34), the immediate mortality becomes 28.1 per cent. Of 69 patients who recovered from the operations, 66.7 per cent have lived more than 5 years. Bergenhem's operation consists of an independent extraperitoneal transplantation of the ureters into the rectum with a rosette of bladder wall and removal of the bladder. Figures show a mortality of 11.5 per cent, and with Stevens' figure added to this 15 per cent. Of 28 patients who recovered from the operation, 60.7 per cent have lived over 1 year and 21.4 per cent over 5 years. The Mayo Clinic has probably had a larger number of cases of exstrophy than any other clinic. Their method of operation is as follows: The ureter is divided about 1 inch from the bladder wall, the lower end is ligated and the peritoneum closed. At a point opposite the isolated ureter, an incision is made through the outer coats of the bowel, and at the lower end a puncture is made through the mucosa, large enough to admit the ureter. The ureter is drawn through and fixed. The divided peritoneum and muscle of the intestine are then approximated over the ureter. One ureter is transplanted at the first stage and in about 10 days the second ureter is transplanted. In third stage the bladder is enucleated and the short ends attached to it removed.

Fig. 1. The exstrophy of bladder. There is an absence of umbilicus, the skin over the region of the umbilicus and down to the rudimentary bladder resembling embryonic scar tissue. The darkened area with two openings in the lower portion represents the rudimentary bladder with the ureteral orifices. The ejeculatory ducts and verumontanum may be seen below the rudimentary bladder in the floor of the urethra. One-half of the circumference of penis including roof of urethra, glans, and prepuce is absent. The dotted lines represent the ends of the transverse rami of the symphysis pubis. The scrotum and testicles are normal.

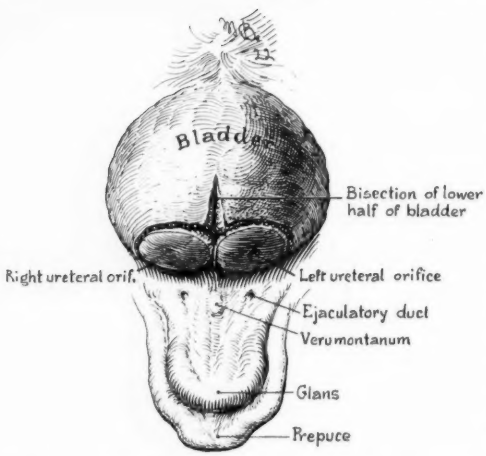


Fig. 2. Herniated rudimentary. Circular incisions showing the section of bladder mucosa with ureteral orifices in the center. Line of incision by which base of bladder was bisected.

In their series of 52 patients, 6 were operated on by the plastic method, one died; 6 months later, 3 were operated on by the Maydl-Moynihan method, two of whom died of uræmia. Twenty-six were operated on by the transplantation method, 22 successfully. Seventeen of the patients examined were not operated on at the time. Some of these were too young, others with diseased or dilated ureters were advised against operation.

Since Stevens' report, the Maydl procedure has been carried out in the following cases:

1. Mugincy's case; patient living.
2. Nové-Josserand's case; patient living 1 year after.
3. Moorehead's case; a man aged 20, died on the seventh day, from peritonitis.
4. Moorehead's case; a woman aged 26, living 1 year after, at the last report.

In the following cases Bergenhem's operation has been carried out since Stevens' report:

1. Coleman's case, a boy of 18 years; operation February 2, 1916; well 2 years later.
2. Mueller's case; female, aged 36, operation in 1917.
3. Holman's case; female, aged 36, operation in March, 1918. Living and well in January, 1920.
4. Joseph Burke's case; female, aged 16; operation June 14, 1920.
5. Authors' case; male, aged 5 years, operation, lived 2 years after operation and died of influenza.
6. Authors' case; male, aged 19, operation November 17, 1919; living and well, October, 1922.

When we consider these two methods and compare them, we find a much higher primary mortality following the Maydl operation. Naturally any method which necessitates opening the peritoneal cavity must tend toward a high mortality, mainly on account of the greater chances for infection, and the greater risk from shock. The extraperitoneal operation, therefore, in our opinion, is the easiest and the safest method of transplanting the ureters in exstrophy of the bladder. With any method, transplantation of the ureters, if it be carefully and properly done, is of necessity a very delicate piece of work, and the dissection must be made in such a way as to cause a minimal amount of trauma, so that the nerve and blood supply to the parts may not be destroyed or materially injured. When the Bergenhem method is employed, the rectum should be carefully cleansed before operation. The ureters should be dissected out far enough so that, when transplanted, they will not be subjected to any degree of tension. Kinks and twists should be carefully avoided.

Case 1. C. K., male, age 5. Except for the congenital exstrophy the family and personal histories have no bearing upon the condition. In spite of remarks by his playmates concerning his wet and smelly clothing, he is neither cowardly nor belligerent. On account of his constantly wet clothing, it has been necessary for him to stay indoors until warm weather returned each spring. As a result of irritation by the urine, he always suffers from a burning in the region of the bladder, perineum, and inner portion of both thighs. He eats well and sleeps well, usually alone. His mother states that she would rather see him dead than go on as he is. Born with a "leaky bladder," he has been burdened continuously with its effects. Otherwise he has been a healthy boy.

Physical examination shows a fairly well nourished, and well developed boy, from the umbilicus up. Instead of showing a normal umbilicus this region of the abdomen is occupied by a triangular area of embryonic scar tissue, with its apex where the umbilicus should be normally and its base cor

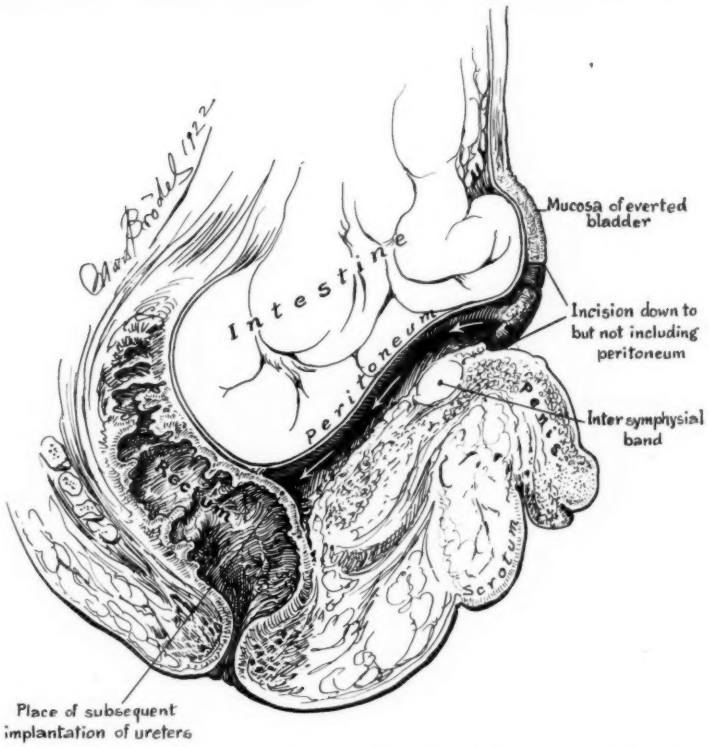


Fig. 3. Dissection of ureter and pushing back of peritoneum. Line of dissection showing peritoneum and exposing anterior wall of rectum and intersymphysial band.

responding to a line normally occupied by the symphysis pubis and its rami. There is a hernial protrusion in this area, which extends from one rectus abdominis muscle to the other. These muscles are apparently normal above the deformity, but from the point normally occupied by the umbilicus downward they diverge, and are attached to that portion of the incomplete pelvic ring which corresponds to the rami of the pubis. The pyriform muscles are apparently absent. In the lower portion of this triangular area there is an area sharply contrasting in appearance with that of the pigmented skin above. This area is fiery red in color, very moist with urine, and covered with a layer of mucus, which is rather tenacious. This is definitely mucous membrane lining the posterior wall and the base of an incomplete bladder. The surrounding skin is red and excoriated. After the surface has been dried carefully with a sponge, the ureters are easily found and intermittent spurts of urine can be seen to escape and run down the thighs.

There is an absence of the symphysis pubis together with portions of the rami. The verumontanum and ejaculatory ducts are plainly visible. There is no roof to the urethra, and the penis looks as though it had been split into equal halves, from end to end, the upper half having been completely removed, the other half remaining undeveloped. The hips are wide, resembling those of a female. There is a very dense band of fibrous tissue in the region usually occupied by the symphysis. Even at the age of six the pelvis is rigid and the boy walks in an erect and graceful manner.

A differential diagnosis between congenital exstrophy of the bladder, acquired exstrophy, and destruction due to infection or malignant disease is not difficult.

In addition to exstrophy of the bladder, he also has a hernia of the abdominal wall occupying the deformed area, diastasis of the recti muscles, congenital absence of part of the tissues in the lower mid-abdominal wall, absence of the symphysis pubis and part of its rami, complete epispadias.

From the standpoint of treatment, the following problems present themselves:

1. To provide storage for the flow of urine where it may be retained for a reasonable time and from which it may be evacuated voluntarily;

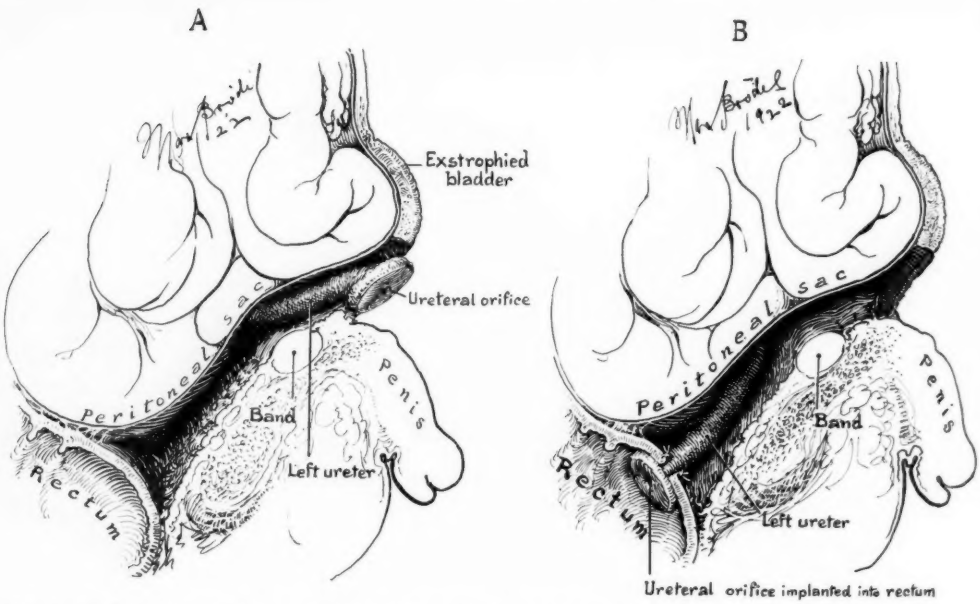


Fig. 4. *A*, Dissected ureter being adjusted. *B*, The ureter inserted into the slit into the rectum, and sutured in place.

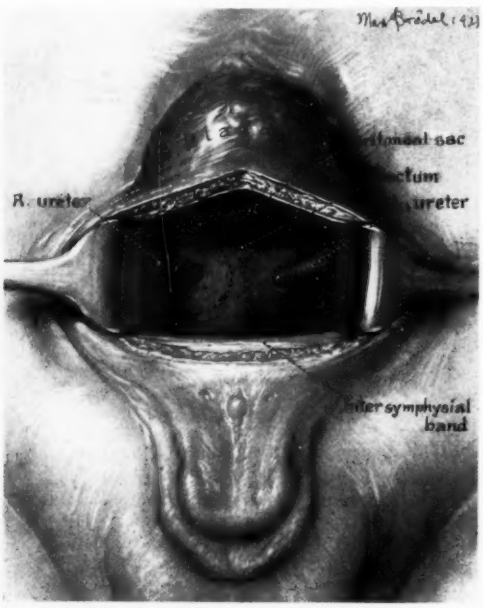


Fig. 5. Shows the bisected bladder and the intersymphysial band. The transplanted ureters in place with bulging peritoneal overlying sac.

2. To bring about complete removal of the crippled and conceivably dangerous rudimentary bladder;

3. To cure the hernia by a plastic operation;

4. To bring about restoration of the urethra, while conserving the accessory organs of reproduction;

5. To complete the bony ring of the pubis by means of bone graft, which may be desirable, but is unnecessary if the fibrous band is left uninjured.

Operation May 11, 1917. Under ether anæsthesia the orifices of the ureters were located and ureteral catheters inserted for some 8 to 10 centimeters, care being taken not to allow them to extend farther. Circular incisions were made around each of the ureteral orifices, extending through the bladder wall in such a manner that segments of the two circles were in contact (Fig. 2). This was done to "conserve in so far as possible, the anatomical and physiological relations that obtain in that portion of the bladder wall which the ureters traverse."

While the possibility of conserving the nerve supply to these ureterovesicular structures to our minds is questionable, conservation of the blood supply to the dissected portion of the ureter is a different problem, and is not only desirable but seemingly necessary.

To accomplish this economy of blood supply, care was exercised in dissecting the circular area of the bladder and the ureters, and the bleeding vessels were caught with fine-pointed clamps. We also felt that, in dissecting out the ureters, it was well worth

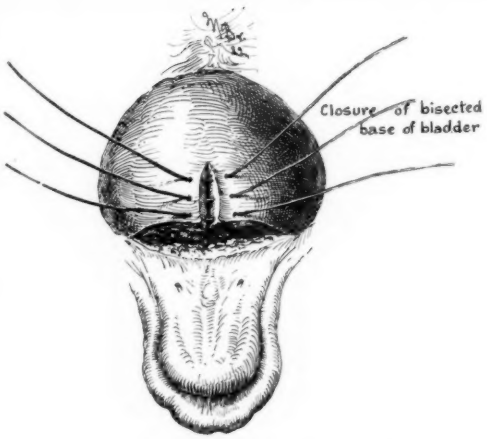


Fig. 6. Closure of partially bisected bladder.

while to keep as far away from them as possible, so that they would be practically tucked away from injury, and remain secure in a tube or sheath of mobile tissue. Localization was rendered much easier by means of catheters placed in the ureters. Having, then, conserved the valve-like mechanism about the ureterovesicular orifice and the blood supply and possibly the nerve supply to the ureters so far as we could, we then bisected what would normally represent the base of the bladder in the midline and conserved the vas on either side together with the structure in the floor of the urethra. We then carried the dissection down to the floor of the pelvis (Fig. 3), keeping behind the dense band of fibrous tissue which joined the rami, at the same time using great care not to enter the peritoneum. The peritoneum was easily pushed back and the rectum exposed. Two small incisions were made into the rectum, one on either side and about 1 centimeter from the mid-line (Fig. 4). The dissected ureter was then gently curved backward, and by means of a catgut suture inserted into the mucosa of the circular area, with a Kelly clamp in the rectum, the end was drawn through the opening into the rectum. By means of two catgut sutures placed on either side at the junction of the ureter and the rectum, the opening into the rectum was closed in such a way that the ureter was not constricted. Care was exercised to prevent the dissected ureter from being kinked or twisted at any point (Fig. 5).

Although both ureters were dissected out in a one-stage operation in our cases, there was no apparent disturbance in the kidney function. Hence we feel that, if the condition of the patient justifies it, the operation should be attended with less risk, and certainly it would appear that convalescence should be less complicated, when all of the urine is flowing into the rectum than when the operative field is constantly bathed with secretion from the

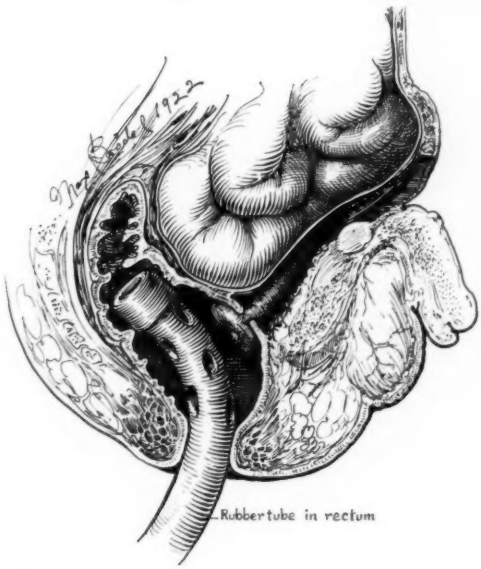


Fig. 7. Completion of the first stage in the operation. Rectal tube with fenestræ, in place.

undisturbed ureter. In our cases, the results have seemed to justify this conclusion. We did not feel, however, that it would be consistent with good surgical judgment to subject our patient to any further ordeal at that time. He had had enough for that day. This stage of the operation was therefore completed by closing the incision through the base of the bladder (Fig. 6).

Anticipating trouble as a result of leakage of urine around the ureter if the pressure in the rectum were allowed to rise sufficiently high, a rectal tube with fenestræ at various levels and with a cuff turned back at the end was inserted into the rectum, as soon as the patient was taken back to his room (Fig. 7). The secretion began to flow immediately

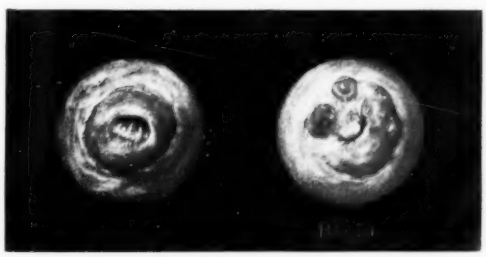


Fig. 8. Ureteral orifices as viewed through the proctoscope. Outer zone of smooth mucosa of the rectum, inner zone, elevated mucous membrane with a depressed ureteral opening in the center.

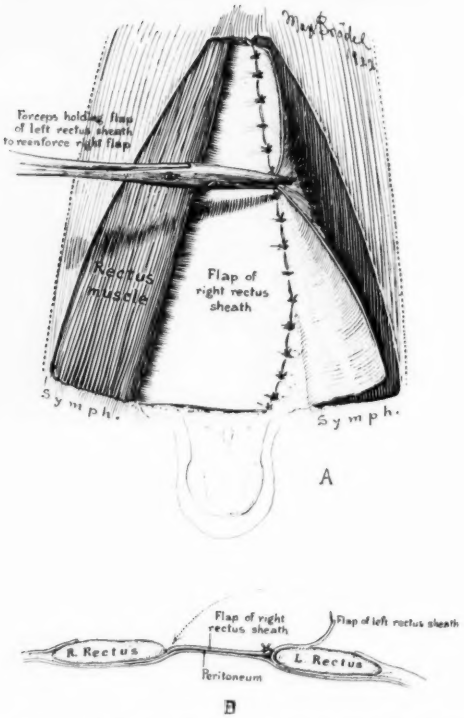


Fig. 10. *A*, Skin and fascia dissected back on either side. Sheaths of recti split and overlapped in midline. *B*, Final step in plastic operation for cure of hernia, overlapping of the recti sheaths. Impossible to approximate the recti muscles. Pyriformes absent.

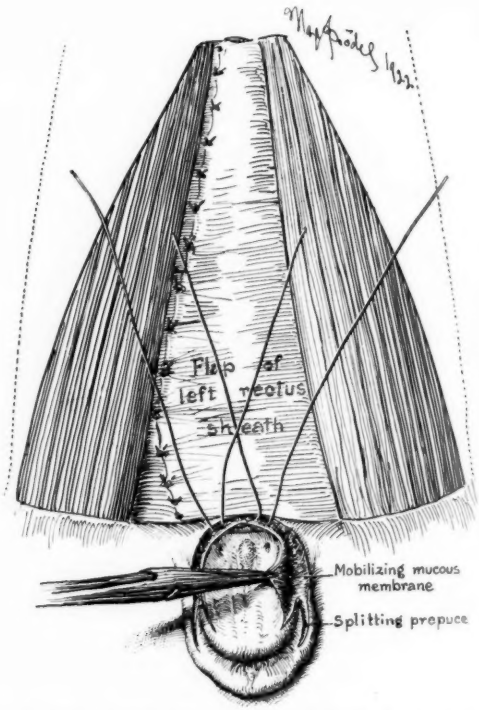


Fig. 11. Plastic operation on the penis for cure of epispadias. Mobilizing mucous membrane of urethra by incision along the mucocutaneous margin. Splitting of prepuce to complete the incomplete urethra.

and was collected in an appropriate receptacle. Although it was impossible to measure accurately the amount of urine, there was no appreciable embarrassment of the kidneys. Twenty-four hour specimens taken one week apart showed the following amounts of fluid recovered from the bowel:

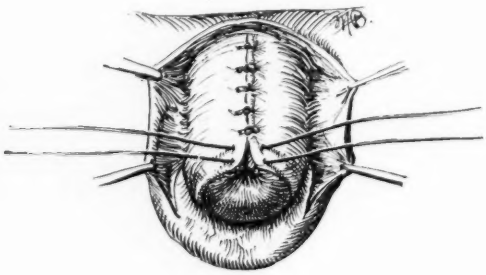
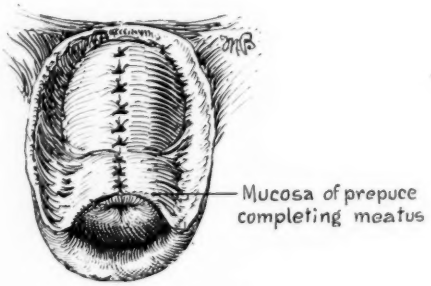


Fig. 12, *A*.



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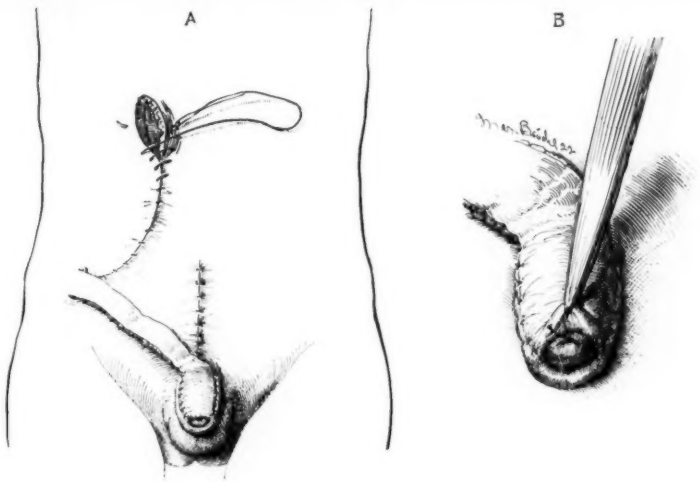

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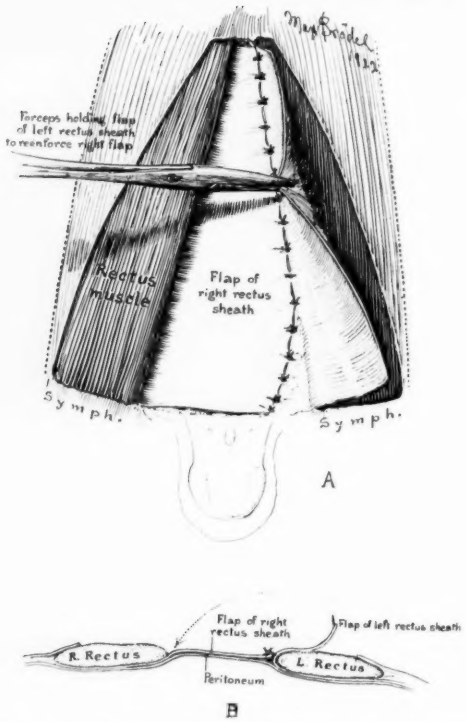

Fig. 10. *A*, Skin and fascia dissected back on either side. Sheaths of recti split and overlapped in midline. *B*, Final step in plastic operation for cure of hernia, overlapping of the recti sheaths. Impossible to approximate the recti muscles. Pyriformes absent.

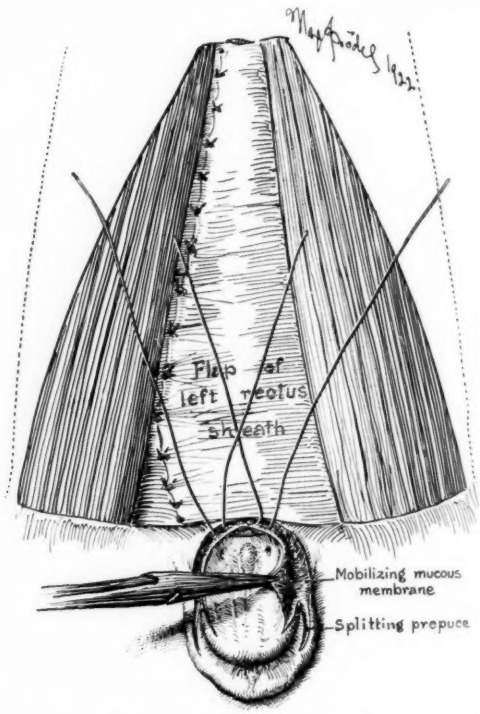

Fig. 11. Plastic operation on the penis for cure of epispadias. Mobilizing mucous membrane of urethra by incision along the mucocutaneous margin. Splitting of prepuce to complete the incomplete urethra.

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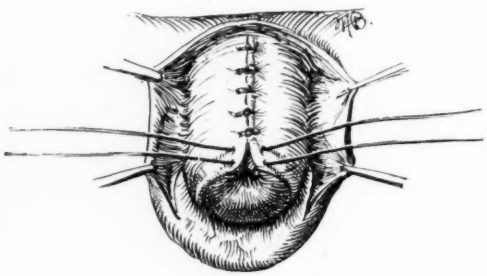

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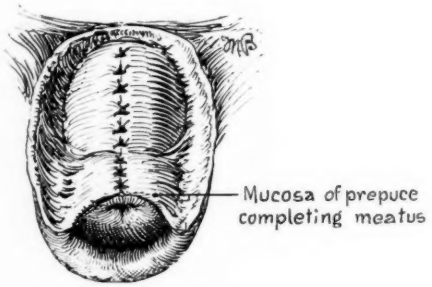

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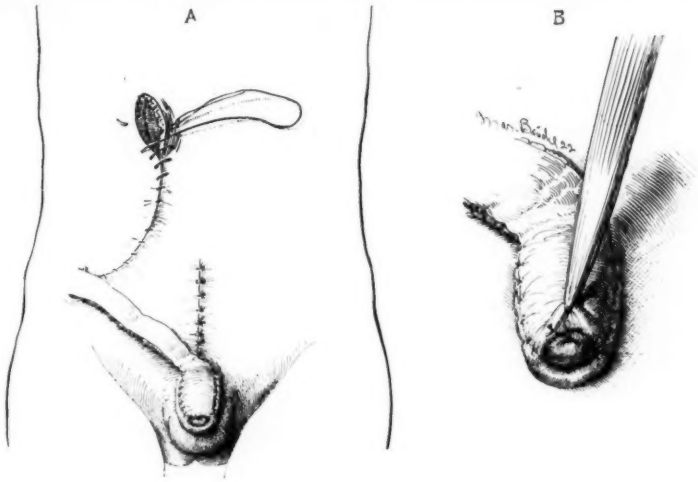

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KIELLAND OPERATION FOR PROLAPSUS UTERI[1]

By H. J. BOLDT, M.D., F.A.C.S., New York, New York

IT is my purpose to describe a modification of an interposition operation which was devised by Dr. Chr. Kielland of Christiania, Norway, and which has for its purpose the placing of the uterus, in its entire length, on the anterior vaginal wall in a straight line, parallel to the vaginal axis (Fig. 11), and the narrowing of the vaginal caliber.

The vaginal portion of the cervix is pulled forward and upward so that the posterior surface of the prolapsus presents itself to the operator. Beginning at the cervical opening by excising a wedge of the posterior lip with a base scarcely 0.5 centimeter wide Fig. 1, *B*, (of course, the size depending upon the diameter of the portio) and continuing with downward incisions 6 to 8 centimeters in length, gradually diverging (Fig. 1, *A*). The flap between the incisions is separated from above downward, Fig. 1. *C*, but not cut off, and is placed beneath the retractor (Fig. 2, *A*).

It may happen, during the separation of the flap, that the peritoneum of the cul-de-sac of Douglas is opened. If so, then it must again be closed by suture. The vaginal mucosa, beginning at the edge of the incision on either side of the portio vaginalis and cervix, should be separated from the underlying structure, starting with a pair of blunt-pointed scissors, curved on the flat, and continuing with the finger to such an extent that the finger may surround it half way or even to a slightly farther extent (Fig. 2, *B*). The undermining must be done to within about 0.75 centimeter of the terminal of the portio vaginalis. At this part the scissors must be used, but one should be careful not to perforate the mucosa. The undermining and the wedge-shaped excision are necessary for the subsequent inversion of the portio and the cervix.

The posterior wound surface is now united for a length of from 6 to 8 centimeters, start-

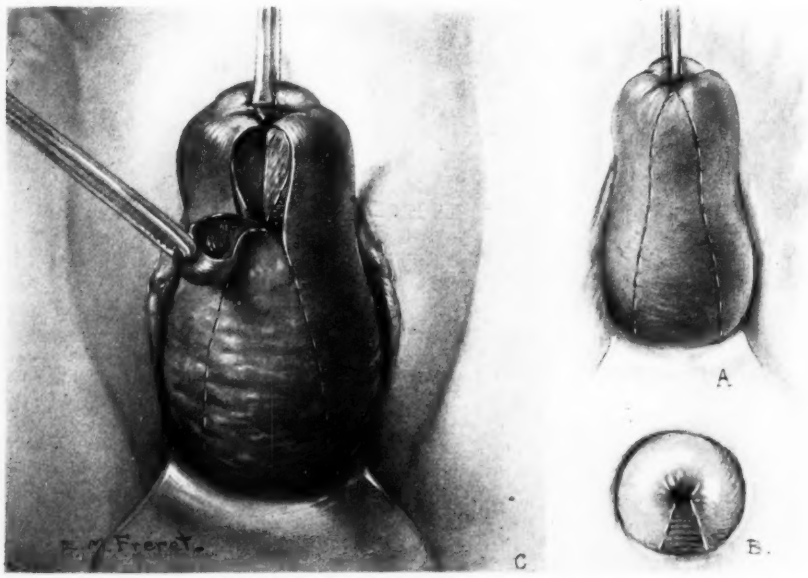

Fig. 1. *A*, Incision on posterior surface; *B*. exsection of cervical wedge; *C*, separation of the flap from above downward.

[1] Read before the Southern Surgical Association, Nashville, December 12–14, 1922.

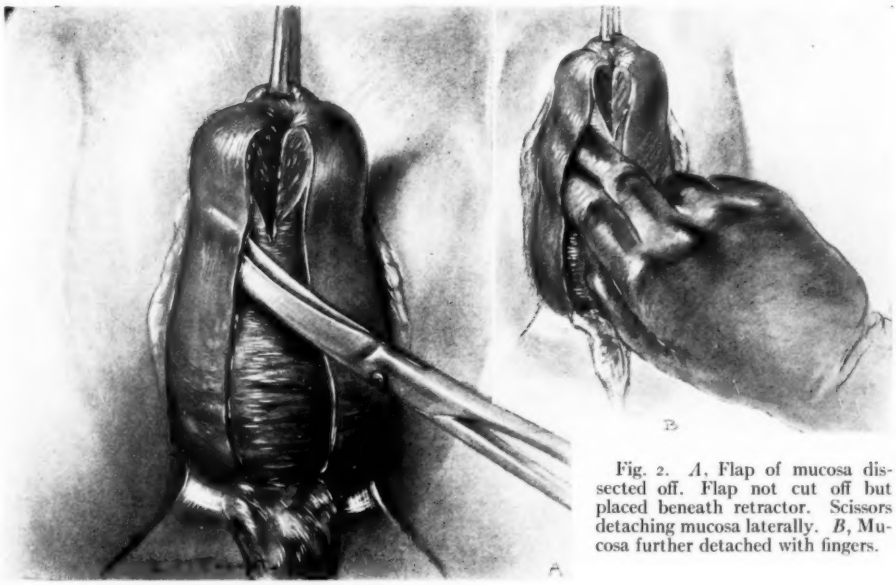

Fig. 2. *A*, Flap of mucosa dissected off. Flap not cut off but placed beneath retractor. Scissors detaching mucosa laterally. *B*, Mucosa further detached with fingers.

ing at the posterior lip. This, however, applies to the mucosa only, for the underlying structures must not be included in the suture (Fig. 3). The suture is tied and left long, to be used for traction if desired, later, when inverting.

Now the vaginal portion of the cervix is drawn downward, and the anterior surface of the prolapse is operated upon. An oval flap is resected beginning about 0.5 centimeter beneath the urethral orifice and terminating at the cervical opening. This, then, excises the larger part of the urethral redundancy (Fig. 4).

A similar small wedge as was excised from the posterior lip is likewise excised from the anterior lip of the portio vaginalis; the size of this also depending upon the size of the portio vaginalis. In instances of broad, flat, mushroom-like vaginal portions, the excision must be larger; it must always be sufficient to make the portio somewhat conical for the purpose of inversion.

The width of the flap to be extirpated will depend upon the thickness of the tissue and the size of the existing cystocele. On either side of the prolapse there should remain about two fingers' width of the mucosa, if one wishes to retain a medium-sized vagina.

On the anterior surface the mucosa (after excision of the flap) should be separated about a finger's width (Fig. 5), and a little more toward the urethral terminus, because this part of the mucosa is destined to cover the anterior surface of the uterine body.

These edges are now grasped with two pairs of small mouse-toothed clamp forceps, about 0.6 centimeter, this side of the upper wound terminus, (Fig. 5), to enable one, more readily, to draw the mucosa in front of the uterine body when, later on, the wound is to be closed.

The bladder is now separated from the cervix, starting with the customary transverse incision, and pushed upward. The viscus should not be separated so far laterally as is usually done in the customary interposition operation, and the Luschka bladder pillars should not be injured.

When the vesico-uterine plica has been opened and the bladder catheterized for control, the body of the uterus is brought forward through the opening (Fig. 6.) The tubes are then ligated (I prefer to excise a part of each tube at the uterine cornu, H. J. B.) and the bladder peritoneum is attached to the posterior uterine surface at about the corpo-cervical junction.

Fig. 3. Posterior mucosa united. The finger is introduced only to show that the cervical musculature is not included in the suture.

Fig. 4. Anterior flap taken off.

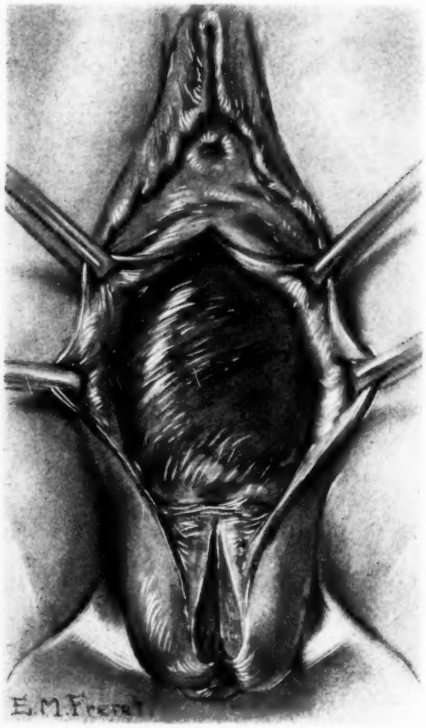

Fig. 5. Mouse-toothed forceps grasping wound edges making it possible to draw the mucosa more readily in front of the uterine body when the wound is to be closed.

Kielland does not consider it essential to sew the peritoneum to the uterus, since this may cause a slipping back of the body into the peritoneal cavity, thus making somewhat tedious work, because of the necessity of bringing it forward again.

A gauze strip is placed down to the point of suture, between the bladder and the uterus, and brought out at the upper wound opening as a small cigarette drain.

The anterior vaginal wound may now be united by two methods:

1. A continuous suture of the vaginal wound, including the corpus uteri and the cervix in the suture, beginning at the wound's upper angle. The first suture, which includes the corpus, should be placed on the anterior surface of the fundus, not higher up than the origin of the round ligaments; *not at the sum-*

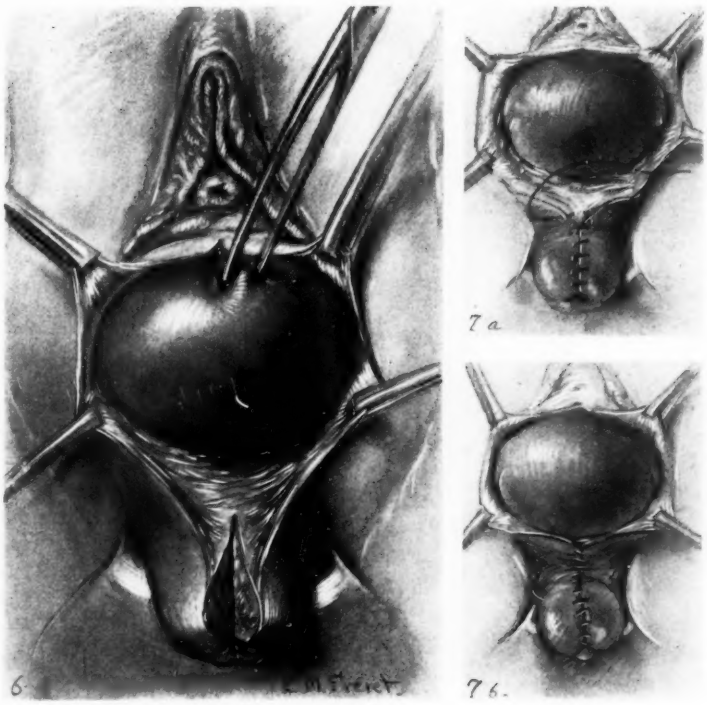

Fig. 6 (at left). The body of the uterus is brought forward through the opening.
Fig. 7. The cervix and the portio vaginalis are inverted into the vagina.

mli of the fundus nor on the posterior surface. This method, of using only a single line suture, is applicable only in instances of small prolapsus, or in the case of senile uteri.

2. As a rule, in the case of larger prolapsus, it is more convenient to make the suture in two stages. One begins at the lip of the cervix and sews upward to above the corpo-cervical junction. Here this suture is discontinued. The cervix is included in the suture. Now the cervix with the portio vaginalis may be inverted into the vagina (Fig. 7).

To accomplish this one finger presses upon the portio (Fig. 8), while simultaneously, the other hand pulls on the posterior vaginal flap, or on the knotted catgut suture left there when having worked on the posterior surface. When this has been done the distal half of the vagina has been formed. In the depth of this vagina one no longer feels a portio vaginalis; only the anterior lip and cervical opening are palpable. The posterior lip has been obliterated to touch.

Now the corpus uteri, if it is still protruding between the vaginal wound edges, is pushed back to its future position beneath the bladder. The vaginal wound edges, with the aid of the small-toothed forceps that have previously been placed upon them, are brought forward in front of the corpus. Should it be seen that there is too much vaginal mucosa for a moderately taut covering of the corpus, so much of the tissue as may be necessary should be excised.

The uniting of the edges should begin above, from the upper wound angle (where the gauze drain was placed, Fig. 9) and continued downward to the first suture. The stitches, beginning with the first, also take in the uterine musculature, at least every second stitch. A plastic operation upon the pelvic floor completes the operation. A Hegar flap is

Fig. 8. Method of inverting cervix and portio vaginalis into vagina.

extirpated, by continuing the incision made for the posterior flap on the posterior vaginal wall (Fig. 1). The upper point of the triangular Hegar flap will lie at the catgut knot (Figs. 3 and 10). The external incision over the perineum *is not made transversely*, but bends into a point toward the anus (Fig. 10). The edges of the vaginal wound are united by a continuous catgut suture.

The underlying (venous) tissue is not taken in by the sutures in the Kielland operation. Only from about the carunculæ myrtiformis to the perineum the stitches penetrate more deeply on the lateral wall into the tissue. Interrupted sutures are used for the pelvic floor. The levators are not sutured, except in cases of rectocele. The perineum is united with somewhat deeply placed silkworm stitches or those of fine catgut.

Kielland also places a small glass tube, 3 to 4 centimeters in length, before placing the las stuture, and fastens it with the last stitch. This is removed on the evening of the operation day. (For this I have not found a neces-

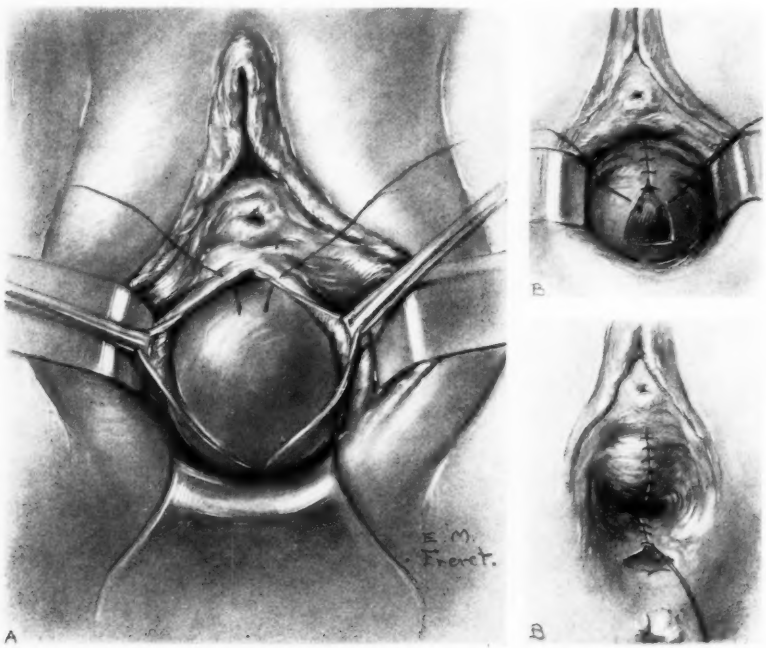

Fig. 9. *A*, Placing the first suture. *B*, continuing the suture.

sity, H.J.B.) The vagina is tamponed to the external orifice. A "T" binder is applied. The gauze strip or cigarette drain tampon is removed on the third or fourth day.

The operation, in a suitable instance, is not difficult from a technical point of view, since in cases of complete prolapsus the entire operation is done in front of the vulva. Only the suturing of the middle section of the anterior vaginal wall to the body of the uterus, and, possibly, the cervix and the upper part of the vaginoperineal plastic are done in the interior.

One of the most important factors in all interposition operations is the judgment as to how much of the anterior vaginal wall must be excised. If the uterine body has been placed too far forward with the fundus against the vagina, or if the vagina has been separated too far laterally, it is possible to have a cystocele-like protrusion immediately following the operation. If, on the other hand, the technique has been correct, one should see a plane surface, or still better, a slight retraction following the inward placement of the corpus uteri. When the cystocele-like bulging occurs it may be overcome by excising an oval-shaped flap from the vagina and a wedge-shaped excision from the uterine body; then closure of the wound.

Kielland asserts that in more than 150 such operations he has not seen one recurrence. The technique described has been used by him since 1911.

Fig. 10.

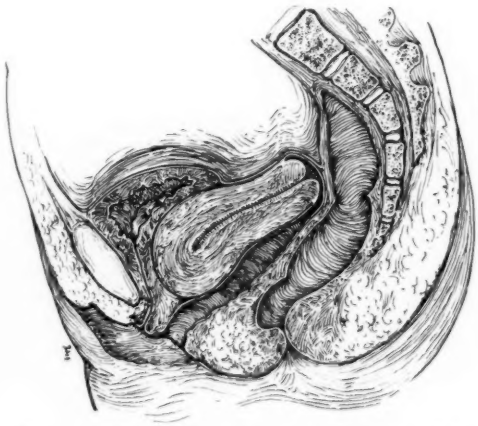

Fig. 11. Position of the uterus after completion of the operation.

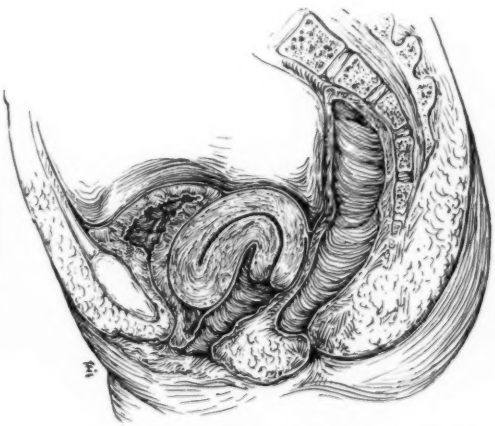

Fig. 12. Position of uterus in original interposition operation, when vaginal part of cervix was not amputated.

The modification of Kielland refers principally to the treatment of the vaginal portion, which is not amputated but utilized as a prevention against a recurrence. The exclusion of a recurrence by this method of operating does not depend upon a lifting, suspension, or fixation of the vaginal portion, since this may be loosened by subsequent intra-abdominal pressure. The exclusion of recurrence depends upon static reasons: The position of the uterus is straight and in parallel position with the axis of the vagina (Fig. 11). Intra-abdominal pressure acts on the posterior surface of the uterus and transversely to its long axis, and, therefore, presses the uterus against the posterior vaginal wall—and not out of the vaginal outlet (Fig. 11).

Because of the retention of the entire uterus, the anterior vaginal wall has become more rigid, so that with the change of the vagina the organ cannot be pressed out.

Kielland claims that, inasmuch as no levator suture is used, except in instances in which rectocele is present, it is proved that levator suturing is not required in cases of prolapsus uteri.

FRACTURES IN TRANSPLANTED BONE

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From the Surgical Pathological Laboratory of Leland Stanford Junior University School of Medicine

THE success of an entire graft of any tissue is dependent upon the ability of the cellular elements of that particular tissue, to remain viable after the complete severance of its vascular supply and thereby retain its life properties until such a time as its vascular supply is re-established. This temporary destruction of its blood supply with the loss of the essential nutrient elements, necessarily inflicts a considerable injury to the cellular components of the graft, which in part undergo more or less degenerative changes, and some of the cells may even die. In the case of the bone graft it is believed by the majority of investigators that many of the osteoblastic cells of the transplant survive and at least share in the regenerative processes. Their deductions are based on the results of careful microscopical study of transplanted bone, especially of bone buried in muscle. On the other hand, some investigators still maintain that there is practically a complete degeneration of the cells of the transplant and that all active regenerative changes are dependent upon a secondary ingrowth of osteoblastic tissue from outside of the graft.

It is of prime importance in considering the healing of fractures in transplanted bone to know definitely if the cells of the transplant possess an independent, inherent power of proliferation and repair. If the osteoblastic tissue of the graft is inactive then the healing and callus-forming cells are dependent upon an invasion from the exterior into the transplant. Therefore, if a fracture occurs in a transplanted piece of bone before such an invasion takes place, its healing will have to wait until such a time as the new osseous elements will have reached the site of the break. On the other hand, if the graft possesses independent powers of proliferation, then the reparative activities will proceed at once and may be completed before the penetration of new bone from the host. Thus, it is seen, that it is of considerable importance, both from the scientific as well as from the clinical aspect to determine if the cells of the transplant are endowed with this power of proliferation and repair.

Almost every surgeon who has utilized the free bone transplant has experienced the occurrence of a fracture of a graft. In a recent article, S. Alwyn Smith (1) gives some interesting data and views on fractures taking place in grafts of bone. He is of the opinion that the greater part of the graft dies and is absorbed and replaced by osteoblasts derived to a certain extent from the surface, but principally from the endosteum of the host bone at either end. He believes that the graft acts as a scaffold for the ingrowing bone from the host. Smith divides the fractures occurring in transplants, into two types: One, the disintegration fracture occurring about the sixth to the eighth week at a time when absorption outstrips restitution, and due to stress or strain associated with the lack of rigid immobilization. The other type, he designates as the clay pipe stem fracture, which occurs about the third or fourth month after operation and at such a time when the graft depends entirely on its mineral constituents for its strength. Unfortunately, this subject can not be dismissed with this simple classification and explanation of the causative factors. Other elements must be considered as playing a rôle, such as infection, variable tissue reactions, failure of certain necessary chemical elements, and disturbances in various glandular or other physical properties of the individual.

Little direct experimental work has been done upon this important subject. Phemister (2) in his admirable article on the study of the fate of transplanted bone gives a few observations on fractures taking place in some of the grafts. He found that union took place in the fractures of the reimplanted bones and concluded that the reparative processes were

due to the independent active power of proliferation, residing in the transplant itself. His experimental proof is open to criticism because the transplants were in contact at one or both ends with the normal bone of the host, thereby offering the possibility of an ingrowth or migration of osteoblastic cells from this normal bone.

The author (3) in a recent article has presented some evidence of the inherent power of regeneration in a transplanted piece of bone and in the present article will endeavor to give additional proof of this principle, as well as consider the healing of fractures in such bone.

In studying the healing of fractures in transplanted bone one must take into consideration two processes: namely, the healing of a fracture and the fate of bone after transplantation. In order to obtain a better conception of this problem it is advisable to review briefly the method of repair that takes place in each instance.

Let us first take up the pathological changes that occur after the fracture of a bone. We have become so familiar with the normal healing of a fracture that we merely think of it as a simple process of formation of callus which unites the two ends of the fragments and its subsequent ossification, and we seldom stop to consider the intricate system of regenerative changes which are necessary before the final restitution and repair of the injury is completed. However, I believe, it will be accepted, that with the possible exception of the changes that take place in a bone after transplantation, the healing of a fracture makes more demands upon the natural reparative powers of the body than the repair of any other tissue of the organism. We see immediately after the injury, following the rupture of the vessels, an outpouring of blood and lymph. In response to this stimulation there takes place an inflammatory reaction, most often aseptic, in the surrounding area which is followed by the formation of granulation tissue and organization of the blood clot. Simultaneously one sees evidences of activity in the osteogenic cells about the end of the bone fragments. This is manifested by an increase in number and size of the osteoblastic cells in the region of the periosteum, the endosteum, and about the haversian canals. With the proliferation of these cells there is formed the cartilaginous callus which invades the already formed suitable pabulum of organized blood. The whole process of bridging the gap between the two bone fragments proceeds in a purposeful manner. The temporary cartilaginous callus is transformed into osteoid tissue, which, in turn, becomes calcified to form bone. After the resumption of use of the part, there is an absorption of unnecessary tissue and new bone is layed down where it is required, so that in time there is practically a re-establishment of the normal form of the bone.

If we now direct our attention to the study of a piece of bone after transplantation, it will be found that at first because of the sudden complete destruction of its blood supply and other sources of nourishment, there takes place shortly after removal almost a complete degeneration of its cellular elements, as is evidenced by the changes in the nuclear staining. After this initial stage of degeneration, there is a proliferation of the more resistant osteogenetic cells that have survived, and one finds a proliferation of new bone about the region of the periosteum, the endosteum, the lining of the haversian canals, and on the surface of the trabeculæ. From these various foci of activity, the bone is restored to almost a normal condition. The processes just enumerated take place in transplanted bone, whether it be in contact with live bone or whether it be placed in a muscle and separated and prevented from any possibility of contact with other osseous tissue.

Now having in mind these two systems of repair and regeneration occurring on the one hand in a fractured bone and on the other hand in transplanted bone, under independent conditions and separate environments, let us try to picture what would occur if there should be a demand for both processes to take place at the same time. In considering such phenomena, the question naturally arises as to whether there would be sufficient energy for the repair of a fracture in a transplanted bone, in addition to that required for

the regeneration of the transplant itself? If not, would there be some attempt at repair and in just what manner would this be manifested? Furthermore, would there be a difference both quantitatively and qualitatively in the reaction under functional stimulation or when such stimulation was lacking? In order to obtain some information on the above problems the following series of experiments were performed upon dogs. The operations were done under general ether anæsthesia and with the usual aseptic technique.

In the first group of experiments, an entire metacarpal or metatarsal bone with both its articular cartilages intact, was removed from the animal's foot. The bone was then fractured about the center and the two fragments after being placed in apposition, were reimplanted in the normal position in the foot. The bone thus treated necessarily had its entire blood supply destroyed. In these experiments in which the bones are replaced in the foot, there is the possibility of osseous union with the neighboring bones. In such a case the findings would be open to the criticism that the ingrowing bone exerted an influence on the formation of the callus and that it was not an independent activity of the cells of the transplant.

In the second group of experiments an entire bone was removed from the foot and after being fractured was transplanted to the muscles of the back. The two fragments so buried in the muscles are removed from any possible osseous contact and any proliferative changes taking place must be due to the energy residing in the cells of the transplant. Because of the fact that the bone in the muscle is in an abnormal position and not subjected to the influence of normal functional stimulation, added emphasis must be given to any constructive changes that may arise therein.

In the third group of experiments a similar procedure of reimplantation and transplantation was carried out, with the exception that the fragments were placed in boiling water for about 10 minutes. This was done to determine if the surrounding tissues exerted any influence or formed any active osteogenetic tissue.

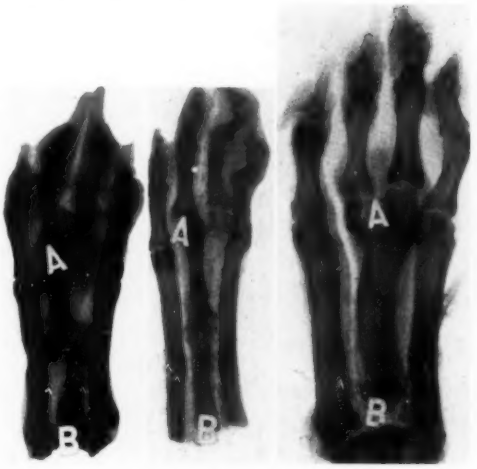

Fig. 1. Fig. 2. Fig. 3.

Fig. 1. Experiment 3. Duration 71 days. The bone, *A*, *B*, was removed from the foot and after being fractured was replaced in its normal position. Notice the large amount of callus at site of fracture. The callus is not completely ossified but gross examination showed firm union.

Fig. 2. Experiment 4. Duration 71 days. The bone *A*, *B*, was removed from the foot, fractured in the middle, and reimplanted in the normal position. Notice the large callus at the site of the fracture. Although this callus was not completely ossified, there were definite signs of firm union on gross examination.

Fig. 3. Experiment 6. Duration 116 days. The bone *A*, *B*, was removed from the foot, fractured in the center, and reimplanted in its normal position. The line of fracture is completely ossified. There is a slight bulging of the shaft at the site of union. The bone is of normal density but is thickened throughout its entire length.

In the fourth group of experiments, one fragment of bone was boiled and the other was not injured. After being placed in apposition they were either reimplanted or transplanted to the muscles of the back. This was done to determine if the normal bone under such adverse conditions would exert any influence over the boiled dead half.

EXPERIMENTS

Group I.—Fractures in Reimplanted Normal Bone

Experiment 1. Duration 14 days. Dog 6

Operation. The fourth metatarsal bone was removed from the foot. It was then fractured in the center in a jagged line, and the two fragments were replaced in their normal position.

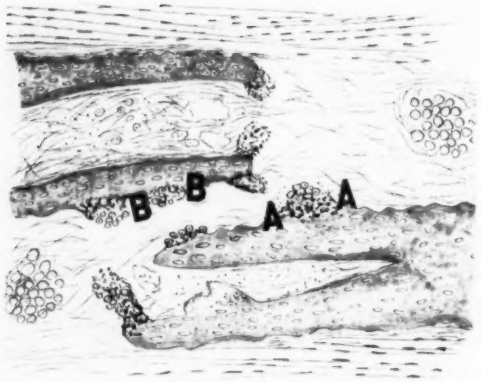

Fig. 4. Experiment 7. Duration 33 days. Diagramatic drawing of two fragments of a fractured bone that was buried in muscle and removed after 33 days. At the ends of the fractured bones, which were overlapping, there were definite outgrowths of bone and cartilage. It is to be noted that these outgrowths are found only within the neighborhood of the planes passing through the ends of the fragments of bone. In other words, it is a purposeful attempt to unite the two fragments by callus formed from the osteoblastic tissue of the transplanted bone. Photomicrographs of the outgrowths indicated by *A*, *A* and *B*, *B* are shown in Figures 5 and 6.

Gross examination. 14 days. The bones were found in good position. They had adhered to the surrounding tissues and showed no abnormal reactions. At this early period, there was no gross evidence of union. The specimen was preserved intact.

Experiment 2. Duration 33 Days. Dog 2, Full Grown

Operation. Removed the fourth metacarpal bone of the left fore foot, fractured in the center, and reimplanted in its normal position.

Gross examination. 33 days. Dog 2. The fractured ends were found in poor alignment. There is no evidence of callus, and the ends of the bone appear smooth.

Microscopical examination. The two fragments, which are not in apposition, make an angular deformity. In this angle there is a considerable amount of cartilaginous callus. The cortical bone contains both stainable and non-stainable nuclei. There is some new periosteal new bone, but no evidence of activity about the endosteum.

Experiment 3. Duration 71 Days. Dog 3, Full Grown

Operation. Removed the third metacarpal bone of the left fore foot, fractured it completely across the shaft except for a small strip of periosteum along one side, and then reimplanted in the normal position.

Gross examination. 71 days. There was a fairly large callus at the site of the fracture and one got the impression of firm union. The roentgenogram (Fig. 1) shows the large amount of callus at the fracture, which with the exception of the central part has ossified. The specimen was saved intact.

Experiment 4. Duration 71 Days. Dog 3, Full Grown

Operation. Removed the third metatarsal bone completely from its bed and after fracturing completely through the center, leaving a strip of periosteum along one side, the two fragments were placed in their normal position.

Gross examination. 71 days. The bones were found well healed in the position in which they were placed. There was firm union at the site of the fracture. The roentgenogram (Fig. 2) showed considerable callus which was not completely ossified. The bones showed only slight evidence of absorption and were of fairly normal density.

Microscopical examination. There is a complete connecting callus between the two fragments. The portion adjoining the bone ends is osseous while that near the center of the gap is cartilaginous. The method of the laying down of the callus is not unlike that which takes place through the healing of any fracture. There is a marked osseous proliferation along the outer side of the cortex beneath the periosteum.

Experiment 5. Duration 73 Days. Dog 1, Full Grown

Operation. In this experiment the first phalanx of the third toe of the right foot was removed and fractured in the center. If was then reimplanted in its normal position.

Gross examination. 73 days. Dog 1, full grown. Subsequent to the operation the fragments became displaced. There was no evidence of union. The specimen was not studied microscopically.

Experiment 6. Duration 116 Days. Dog 4, Young

Operation. Removed the third metacarpal bone from right fore foot and after fracturing in the center, it was reimplanted in its normal position.

Macroscopical examination. 116 days. The fragments have united firmly, and it is almost impossible to make out the old fracture line. On longitudinal section one sees an irregular contour to the shaft. The roentgenogram (Fig. 3) shows complete osseous union at the site of fracture. The bone is thicker than the normal neighboring bones and is just as dense. There is a union of base with the adjoining bones.

Microscopical examination. There is an irregular structure of the cortical bone. In places the nuclei have a fairly normal structure and take the usual stain, while in other parts of the bone they take a poor stain and have a degenerated appearance.

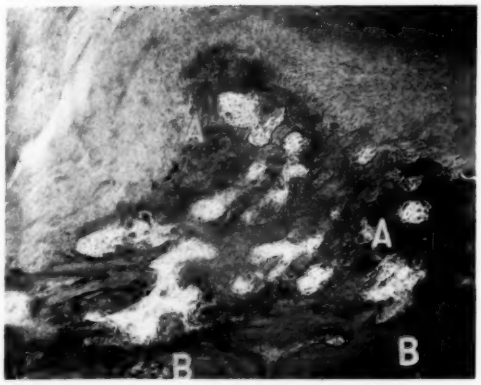

Fig. 5. Experiment 7. Duration 33 days. Photomicrograph of the area designated by *A*, *A* in Figure 4. *A*, New osteoid tissue growing out from the original cortex. Notice the group of cartilage cells at the tip of this mass. *B*, the original cortex. This callus is similar to the callus that forms at the site of a fracture under normal conditions. It is projecting toward the cortex of the other fragment in an endeavor to form a union between the two. The original cortical bone contains faintly staining nuclei and is undergoing a more rapid degeneration than this new tissue arising from its outer surface.

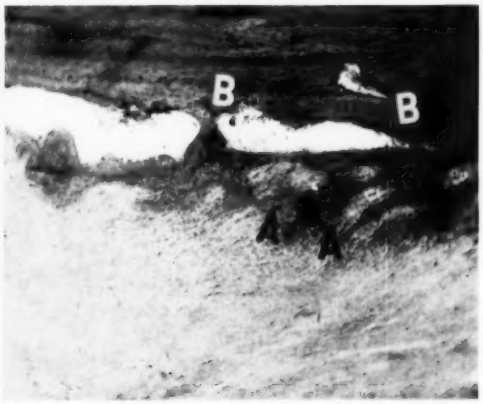

Fig. 6. Experiment 7. Duration 33 days. Photomicrograph of the area marked *B*, *B* in Figure 4. *A*, *A*, Mass of cartilage in the osteoid callus projecting from the cortex of a transplanted piece of bone which was buried in muscle. *B*, *B*, Original cortex of the transplanted bone. Because of the fact that this bone was buried in muscle and therefore removed from the possibility of contact with other osseous tissue, it is held that the callus arose from the persistent osteogenetic cells of the transplanted bone.

SUMMARY ON REIMPLANTED FRACTURES

In three of the six experiments in this group there was definite union of the fractures in the reimplanted bones. In a fourth there was callus about the ends of the fragments, which had separated and made an angular deformity. In the remaining two, the period of observation was too short in one, while in the other the fragments became widely separated following the operation.

The method of union was similar to that which takes place in fractures of undisturbed bones.

GROUP II.—FRACTURES IN TRANSPLANTED NORMAL BONES

Experiment 7. Duration 33 Days. Dog 2. Full Grown

Operation. Removed the third metacarpal bone of the left forefoot and fractured it completely through the cortex, leaving a strip of periosteum along one border. The two fragments were then transplanted to the muscles along the left side of the spine.

Gross examination. 33 days. The bones were found embedded in the muscles of the back. The two fracture ends overlap each other. There appears to be a partial union.

Microscopical examination. The two bone ends, which are not in osseous contact overlap each other, and show some very interesting and instructive cellular changes. It is noticed that in the plane where the bone end of one fragment projects on the shaft of the other fragment, there is an outgrowth of bone attempting to bridge the gap. These outgrowths consist of both osteoid and cartilaginous tissue and are of the same nature as the callus that bridges the gap between any two fragments of fractured bone. This is well shown in the diagram (Fig. 4) and the photomicrographs (Figs. 5 and 6). It is further noticed that at no other place on the cortex is there any evidence of bone proliferation. In other words this is a purposeful attempt to bridge the bone gap and definitely due to the inherent active osteogenetic power of the cells of the transplant. If the tissues external to the bone were responsible then one would expect a uniform change of all the intervening tissue as well as changes at other places along the surface. The original bone of the cortex contains granular nuclei which are larger than normal and appear to be in a stage of degeneration. Some parts of the bone contain normal nuclei, especially about the periphery and along the haversian canals. Except for the periosteal and endosteal borders, it is noticed that the ends of the fragments show an entire lack of activity.

Experiment 8. Duration 33 Days. Dog 2. Full Grown

Operation. Removed the third metatarsal bone from the right hind foot and after fracturing com-

pletely through the center, the two fragments were placed in apposition and buried in the muscles along the right side of the spine.

Gross examination. 33 days. The two fragments became separated so that a non-union took place. One of the fragments was removed, at that time and the other 10 days later.

Microscopical examination. 33 days. There is some new bone proliferation at the ends of the fragments which arises from the haversian canals or from the periosteum. There is evidence of new bone about the periosteum, endosteum, haversian canals, and about the trabeculæ.

Microscopical examination. 43 days. The remaining piece of bone which was removed 10 days later showed no signs of activity. This difference might be due to the injury and disturbance produced by the second operation.

Experiment 9. Duration 71 Days. Dog 3, Full Grown

Operation. Removed the fourth metacarpal bone from the left fore foot. The bone was fractured in the center, the two fragments placed together, and then transplanted to the muscles on the left side of the spine.

Gross examination. 71 days. The two fragments were found in alignment. On manipulation one can detect some mobility at the site of fracture. The roentgenogram showed very little callus at the site of union. At one place there appears to be a connecting osseous bridge (Fig. 7).

Microscopical examination. On one border there is a mass of cartilage between the two ends, which in a series of sections seems to connect the two fragments. The bone ends appear blunt and show no signs of activity. The cortex for the greater part contains stainless nuclei.

Experiment 10. Duration 71 Days. Dog 3, Full Grown

Operation. Removed the fourth metatarsal bone from the right hind foot. The bone was broken in the center leaving a strip of periosteum along one side, and then transplanted to the muscles of the left side of the spine.

Gross examination. 71 days. The bones were found embedded in the tissues of the back, in good position and with firm union. The bones are thinner than normal and have undergone considerable absorption. The roentgenogram (Fig. 8) shows that there is no excessive callus and that which has formed is not completely ossified, as the line of separation is still visible.

Microscopical examination. There is a definite osseous bridge connecting the two fragments. The nuclei of this connecting bone are not exactly normal and might be undergoing degeneration. The nuclei of the original cortex show a much more advanced degeneration, in fact are almost stainless. This would seem to indicate that, after the initial proliferation and repair of the fracture, both the original bone and the new-formed callus undergo degeneration, but the degeneration takes place slower in the latter.

Experiment 11. Duration 77 Days. Dog 1, Full Grown

Operation. In this experiment the first phalanx of the fourth toe of the right foot was removed and fractured in the center. It was then transplanted to the muscles on the right side of the spine.

Gross examination. 73 days. There appears to be definite union of the fragments with slight angular deformity. The roentgenogram showed complete osseous union (Fig. 9).

Microscopical examination. There is definite osseous union at the site of fracture. The bone for the greater part contains stainable nuclei. There has been considerable absorption of the cortical bone.

Experiment 12. Duration 73 Days. Dog 1, Full Grown

Operation. Removed the first phalanx of the fourth toe of the left hind foot, and after fracturing in the middle, transplanted it to the muscles of the left side of the spine.

Gross examination. 73 days. The bone was found in the muscle and union appeared to be quite firm, in spite of the fact that there was considerable absorption. The roentgenogram showed union.

Microscopical examination. There is definite new osseous tissue connecting the two fragments. The nuclei of this tissue stain better than the original cortex. The new bone arises chiefly from the periosteum and endosteum and resists absorption better than the remainder of the cortical bone.

Experiment 14. Duration 116 Days. Dog 4, Growing

Operation. Removed the fourth metacarpal bone from the right fore foot and after fracturing in the middle, transplanted the two apposed fragments to the muscles along the right side of the spine. A strip of periosteum was left intact along one border.

Gross examination. 161 days. The bone has undergone considerable absorption and is quite pliable. The roentgenogram showed complete osseous continuity between the two fragments. The bones have undergone considerable absorption throughout their entire extent (Fig. 10).

Microscopical examination. The microscopical study shows that there is continuous osseous tissue between the two fragments. The new bone stains better than the original cortex and is more resistant to absorption than the remainder of the bone from which it arises.

SUMMARY ON FRACTURES IN TRANSPLANTED BONES

In five of the seven experiments in which fractures were produced in bones that were buried in muscles, there was definite evidence of union of the fractures. The healing varied from the cartilage to the osseous stage, and proceeded in a similar manner to the healing of a fracture in a normal bone.

Because of the fact that a bone buried in muscle is removed from any possibility of osseous ingrowth from other bones, it appears that one is justified in concluding that the callus arises from the osteogenetic cells of the bone of the transplant.

It is an interesting fact that this new bone seems to be more resistant than the original bone of the transplant. However, both the new and old bone undergo a progressive absorption, because of the fact that they are removed from the possibility of normal functional stimulation.

COMPARISON OF THE REIMPLANTED AND TRANSPLANTED BONES

There is a greater amount of callus formed in the reimplanted bone than in the transplanted bone. This is possibly due to the fact that the reimplanted bones are almost immediately subjected to functional stimulation and, therefore, there is a greater amount of motion and a need for an early means of strength, which is most rapidly supplied by an abundant cartilaginous callus.

There is less evidence of absorption in the reimplanted than in the transplanted bones.

There is the obvious possibility of a greater number of failures of union in the reimplanted bones because of the movements of the limb, with resulting displacement of the fragments.

BOILED BONE

Certain investigators, notably Petrow and Baschkirzew (3) have claimed that the new osseous tissue forming in a transplanted piece of bone, arose from an ingrowth of young connective tissue, which by a process of metaplasia was changed to osteoblasts and formed the new bone. Likewise, it might be maintained that the new osseous tissue and callus that united the fractures in the transplanted bone, arose from the surrounding tissue and was not formed from the osteogenetic cells of the transplant itself. In order to determine if there is a possibility of such a metaplasia, it was decided to utilize dead osseous tissue instead of live bone. If the bone could be formed from this surrounding connective tissue, it would be expected that it would have the same possibility of changing in the dead as in the live bone. To investigate the behavior of dead bone the following experiments were performed upon dogs.

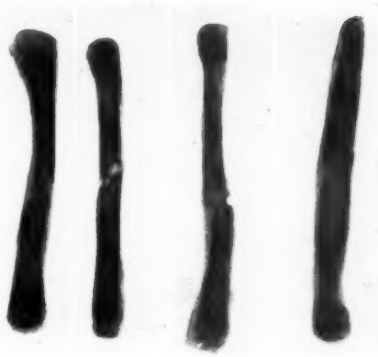

Fig. 7. Fig. 8.

Fig. 7. Experiment 9. Duration 71 days. Roentgenogram of a fractured bone buried in muscle for 71 days. There is very little evidence of callus. The gross examination of the specimen showed partial union. Microscopically a considerable mass of cartilage connects two fragments.

Fig. 8. Experiment 10. Duration 71 days. Roentgenograms of a fracture in a transplanted bone removed from the muscles of the back at the end of 71 days. Notice that there is no excessive callus like that found in the reimplanted bones. Grossly there was firm union, verified as being due to osseous callus by microscopical examination.

GROUP III.—FRACTURES IN REIMPLANTED BOILED BONES

Experiment 15. Duration 8 Days. Dog 8, Growing

Operation. Removed the third metacarpal bone from the left fore foot and fractured in the center. The bones were boiled for 15 minutes and then reimplanted in their normal position.

Gross examination. There was no attempt at healing. Infection.

Microscopical examination. There are no signs of proliferation. The nuclei stain poorly and are quite irregular.

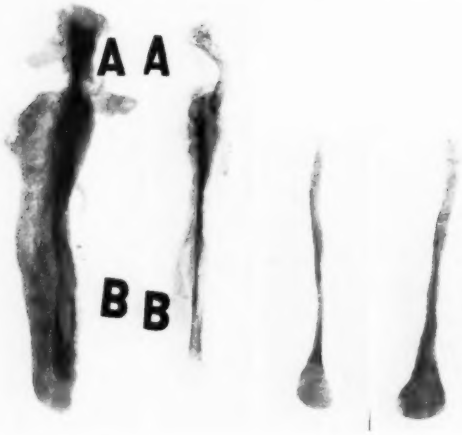

Fig. 9. Fig. 10.

Fig. 9. Experiment 11. Duration 73 days. Roentgenogram of a fractured phalanx removed from the muscles of the back at the end of 73 days. Two views in planes at right angles. *A*, *A*, Phalanx. Notice that union is completely osseous, also that there is a considerable absorption of bone. *B*, *B*, Metacarpal. Not for consideration in this paper.

Fig. 10. Experiment 14. Duration 116 days. Roentgenogram of a healed fracture in a transplanted bone removed from the muscles of the back at the end of 116 days. Two views at right angles. There is complete osseous union. Atrophy of entire metacarpal bone shows that after initial reparative process a secondary degeneration with absorption takes place because of lack of functional stimulation.

Experiment 16. Duration 14 Days. Dog 6, Growing

Operation. Removed the third metacarpal bone from the left fore foot, fractured it in the center and after boiling, reimplanted the two fragments in normal position.

Gross examination. The bones were found to be slightly displaced but showed no signs of proliferation. They were very loosely attached to the surrounding tissues.

Experiment 17. Duration 93 Days. Dog 8, Full Grown

Operation. Removed the third metacarpal bone from the left fore foot. The bone was fractured in the middle, boiled for 5 minutes, and then reimplanted in its normal position.

Gross examination. The bones were found in the position in which they were placed but loosely agglutinated to the surrounding tissues. The bones have the white color of dead bone. The roentgenogram shows considerable erosion of the distal fragment, although the density is about the same as the normal bones (Fig. 11).

Microscopical examination. There is absolutely no sign of callus or any signs of proliferation about the bone ends or in the surrounding tissue. The picture is one of absorption. The nuclei of the cortex are stainless and granular, except for a few in the region of the articular cartilage. These take a heavy stain and appear more nearly normal, which might be due to the fact that they were well fixed by the heat and more resistant to absorption.

Experiment 18. Duration 93 Days. Dog 8, Full Grown

Operation. Removed the third metatarsal bone of the right hind foot and fractured it in the center. The bones were then boiled for 5 minutes and reimplanted in their normal position.

Gross examination. The wound became infected. The bone that remained showed considerable evidence of absorption.

Experiment 19. Duration 113 Days. Dog 9, Growing

Operation. Removed the third metatarsal bone of the left hind foot and after fracturing in the center, the fragments were boiled for about 4 minutes. The two segments were then placed in apposition and reimplanted in their normal position.

Gross examination. At first inspection it was thought that the two fragments had united. Further examination showed that this apparent stability at the site of union was due to the ingrowth of bone from the adjoining normal bone. The roentgenogram shows this union of the transplanted boiled bone with the adjoining normal bone, as well as the absorption of the bone (Fig. 12). There has been a malalignment of the two fragments.

Summary on Fractures in Reimplanted Boiled Bones

In none of the experiments with boiled bones were there any signs of proliferation or new formation of bone.

There was no evidence of changes in the surrounding connective tissue or of the connective tissue that penetrated the boiled bone.

The boiled bone acted as a foreign substance and showed evidence of degeneration.

With boiled bone there appeared to be a greater tendency toward infection and more likelihood of a separation of the fragments. This separation might be due to the lack of the early welding callus.

Group IV.—Fractures in Boiled Bone Transplanted in Muscle

Experiment 20. Duration 8 Days. Dog 7, Young

Operation. Removed the fourth metacarpal bone from the right fore foot, fractured in the center,

Fig. 11. Fig. 12. Fig. 15.

Fig. 11. Experiment 17. Duration 93 days. Roentgenogram of a fractured boiled bone that was reimplanted in its normal position. *A*, *B*, The two boiled segments of bone. The two fragments, which are in mal-alignment show absolutely no signs of union or proliferation about the ends. This is in marked contradistinction to the proliferation and union of reimplanted live bones that were fractured. In the gross specimen the bones appeared dead with no signs of new bone. Microscopical examination showed entire absence of proliferation about ends.

Fig. 12. Experiment 19. Duration 113 days. Roentgenogram of a fracture in a boiled bone reimplanted in its normal position. In this case there was considerable stability at the site of union. The picture shows that this was due to a union of the distal fragment with the adjoining normal metatarsal bone, as well as the proximal fragment at its base, and along the shaft. This exemplifies the point that reimplantation experiments are open to criticism because of the possible invasion of live osteoblastic elements from the adjoining bones.

Fig. 15. Experiment 28. Duration 113 days. Roentgenogram of a reimplanted bone of which the distal half was alive and the proximal half boiled before being placed in its normal position. *A*, Distal live half that was merely removed and then reimplanted. *B*, Proximal boiled half. There is a large amount of callus at the site of junction of the two segments. This callus originates from the normal live half and invades the dead part. Line of union is evident because ossification is not complete. Gross examination showed firm union. Microscopical study revealed a complete callus, partially osseous, partially cartilaginous.

boiled for 10 minutes, and then transplanted the two apposed fragments to the muscles of the back.

Gross examination. There was an infection of the wound. The bones were found loose in the muscles with very little change in the structure.

Experiment 21. Duration 8 Days. Dog 7, Young

Operation. Removed the third metatarsal bone from the left hind foot, fractured in center, boiled for 15 minutes, and transplanted to the muscle of the left side of the spine.

Gross examination. The bones were found loose in the muscles of the back. There was infection of the surrounding tissues.

Fig. 14.

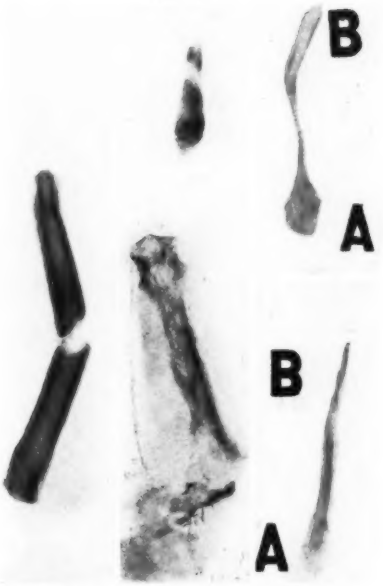

Fig. 13. Fig. 16. Fig. 17.

Fig. 13. Experiment 24. Duration 93 days. This is a roentgenogram of a fracture of a boiled bone, which was buried in the muscles of the back and removed after the elapse of 93 days. There is an entire absence of callus or attempt at proliferation. There is no evidence of a metaplasia of the surrounding connective tissue to form callus between the two fragments.

Fig. 14. Experiment 26. Duration 113 days. Roentgenogram of a fractured boiled bone that was buried in the muscles of the back and removed after 113 days. Proximal fragment has been almost entirely absorbed. There is no evidence of union. Microscopical examination revealed no evidence of callus or proliferation about fracture line.

Fig. 16. Experiment 33. Duration 95 days. Roentgenogram of a fractured bone of which one-half was boiled before transplantation to the muscles of the back, where it was placed in apposition with the other normal segment. *A*, Live segment. *B*, Boiled segment. There is no evidence of union. The boiled half has undergone very extensive absorption. The live half shows less evidence of absorption. There is a slight amount of proliferation about the end of the live half, which is verified by the microscopic study.

Fig. 17. Experiment 34. Duration 113 days. Roentgenogram of a fractured bone buried in the muscles of the back. One segment was boiled before transplantation while the other was placed in its normal live condition. *A*, Boiled segment. *B*, Live segment. There is complete osseous union between the boiled and the live bone. Note the marked absorption, especially of the boiled segment. Roentgenograms taken in planes at right angles.

Microscopical examination. The nuclei of the bone stain, but are larger than normal and have a degenerated appearance.

Experiment 22. Duration 14 Days. Dog 6, Growing

Operation. Removed the fourth metacarpal bone of the left fore foot and, after fracturing in the middle, the fragments were boiled and placed in the muscles on the left side of the spine.

Gross examination. The bones were found in the muscles to which they were but slightly adherent. There were no signs of union.

Microscopical examination. The nuclei stain fairly well. Their form is more irregular than normal, more granular in structure, and larger in size. There are no signs of proliferation at any place.

Experiment 23. Duration 15 Days. Dog 14, Full Grown

Operation. Removed the fourth metatarsal bone of the right hind foot. Fractured the bone in the center, boiled for about 5 minutes, and transplanted the two apposed segments to the muscles on the right side of the spine.

Gross examination. The bones are found in the muscle with no signs of union and very slight agglutination with the surrounding tissues. There is an ingrowing vascular tuft extending into the medullary cavity of one fragment. There is a number of punctate red areas on the epiphyseal end which suggests a vascularization of the bone.

Microscopical examination. There is practically complete loss of nuclear staining, only those nuclei near the lower layers of the articular cartilage being visible. There are numerous new blood capillaries near the epiphyseal end.

Experiment 24. Duration 93 Days. Dog 14, Growing

Operation. Removed the fourth metacarpal bone of the left fore foot. This was broken in the middle, boiled for 5 minutes, and transplanted to the muscles on the left of the spine.

Microscopical findings. 93 days. The bone was found in the muscles of the back which were adhering firmly to the surface. There was absolutely no evidence of union or attempt at such. The roentgenogram shows the erosion of the distal segment. The density of the bones is about normal (Fig. 13).

Microscopical findings. The bone ends are separated by fibrous tissue and show absolutely no signs of proliferation. In fact they are undergoing absorption. The remainder of the cortex is composed of stainless nuclei except for a small area along one border. At this place there are some nuclei that have a normal structure and staining reaction, suggesting the formation of new bone. It must be again emphasized that this is in a very limited area and is either an example of heterogenous bone, a resistant fixed portion of the original bone or some absorptive rather than a reconstructive process.

Experiment 25. Duration 93 Days. Dog 8, Growing

Operation. Removed the fourth metatarsal bone from the right hind foot. Fractured in the middle, boiled for 5 minutes and then transplanted the two apposed fragments to the right side of the spine.

Gross examination. 93 days. The bones were found encapsulated in the muscles of the back and showed no evidence of union. There was some absorption and the bones appeared smaller than normal. The roentgenogram shows the lack of any signs of union. The density of the bones is about normal. Specimen was saved intact.

Experiment 26. Duration 113 Days. Dog 9, Growing

Operation. Removed the fourth metatarsal bone of the right hind foot and, after boiling and fracturing, the two pieces were transplanted in the muscles of the left side of spine.

Gross examination. 113 days. The two fragments were found in the muscles of the back. There was absolutely no sign of an attempt at union. The roentgenogram (Fig. 14) shows almost an entire absorption of the proximal segment and the lack of union or any evidence of callus.

Microscopical examination. There is no evidence of osseous or cartilaginous callus at the site of the fracture, in fact the bone ends are undergoing absorption. The greater part of the cortical bone is stainless. At two places on the outer surface and one on the inner side of the bone, there are similar areas of new osteoid-looking tissue like that described in Experiment 25. The predominating picture is one of absorption and degeneration of the graft.

SUMMARY ON FRACTURES IN BOILED BONE TRANSPLANTED INTO MUSCLE

There was no sign of cartilaginous or osseous proliferation from the bone at the site of fracture, or any attempt at repair of the fracture in dead bones.

It is considered that this is sufficient proof that the callus in the live bone transplants arises from the osseous elements of the transplant, and that the external fibrous tissue plays no part in forming the osseous part of the callus.

In some of the experiments, small areas that looked like new osseous tissue were noticed. This was never seen at the site of fracture, was of very limited size and irregular in

distribution, and was either an example of heterogenous new bone, some resistant fixed osseous tissue, or possibly was of a destructive rather than of a constructive nature.

ONE-HALF BOILED AND ONE-HALF NORMAL BONE

It has been shown in the previous experiments that live transplanted bone possesses sufficient energy, within its cellular elements, to form a union of a fracture in such a graft. Furthermore, it has been shown that the connective tissue external to the graft does not supply any of the osseous tissue as was exemplified in the complete lack of proliferation about fractures in bone that had been boiled. In order to further test this latent energy possessed by the osseous cell of live transplanted bone, it was thought worth while to determine if a live segment of bone would exert any influence on a boiled segment of bone, or make any attempt at repairing this lesion. Such an experiment would also give an opportunity of studying the effect of the tissues and the behavior of live and dead bone transplants under exactly similar conditions.

Two sets of experiments were performed in which, after removal of a metatarsal or metacarpal bone, it was fractured about the center. One half was boiled for from 5 to 15 minutes while the other half was not disturbed. The two segments were then reimplanted in their normal position or the two apposed segments placed in the muscles of the back.

Group V.—Reimplanted One-Half Boiled and One-Half Normal Bone

Experiment 27. Duration 86 Days. Dog 12, Full Grown

Operation. Removed the third metatarsal bone of the left hind foot and divided it about the center into two fragments. The distal half was boiled for about 5 minutes and then reimplanted with the corresponding half in its normal position.

Gross examination. 86 days. The two fragments became separated, and there was no sign of union.

Experiment 28. Duration 113 Days. Dog 9, Growing

Operation. Removed the fourth metacarpal bone from the right fore foot and fractured in the center. Proximal half was boiled 5 minutes and then reimplanted with remaining half in normal position.

Fig. 18. Experiment 34. Duration 113 days. Photomicrograph of a section through the site of union of a boiled half of a bone with a live half of the same bone, after transplantation to the muscles of the back. Specimen removed at the end of 113 days. *A, A,* Dead half of the bone. *B, B,* Live half of the bone. There is a definite osseous union between the two fragments of bone. Note the invading finger-like processes of new bone in the dead bone. As there is no other osseous tissue in contact with these pieces of bone, the osteogenetic elements of the live half possess sufficient power of proliferation to form this union. This is considered as being an extreme test for and positive proof of the independent power of growth and repair of osteoblastic tissue after transplantation.

Gross examination. 113 days. The bones have healed in the position in which they were placed. The union at the site of fracture appears to be firm, and there is a moderate amount of external callus. The two fragments are of the same size and do not appear to be connected with the adjoining bones. The roentgenogram (Fig. 15) shows the large callus arising from the distal, normal segment, and evidently invading the boiled half. The line of union is still present as ossification of the callus is incomplete. The boiled proximal fragment is undergoing more extensive absorption than the normal distal half. The medullary cavity of the boiled segment is more distinct than in the normal, most likely due to the lack of regenerative changes. There appears to be a synostosis with the adjoining bones.

Microscopical examination. At the site of fracture there is a large cartilaginous callus which is undergoing calcification and becoming osseous near the bone on either side. This new bone appears to arise from the live normal segment with which it is in more intimate contact. The normal bone is composed of stainable nuclei and shows less evidence of absorption than the boiled segment.

SUMMARY ON ONE-HALF BOILED AND ONE-HALF NORMAL REIMPLANTED BONES

The one positive experiment shows that under favorable conditions, there is sufficient

power of proliferation of the cells of one-half of a reimplanted bone to produce sufficient callus, to unite it to the dead remaining half of the bone.

Group VI.—Transplanted One-Half Boiled and One-Half Normal Bone to Muscle

Experiment 29. Duration 5 Days. Dog 16, Growing

Operation. Removed the third metacarpal bone from right fore foot and broke it into two parts. The distal half was boiled and then placed in contact with the normal half in the muscles of the right side of the spine.

Gross examination. 5 days. The two bones were found in good alignment with a bloody exudate at site of fracture.

Microscopical examination. The two fragments appear degenerated and are devoid of any signs of proliferation.

Experiment 30. Duration 41 Days. Dog 15, Growing

Operation. Removed the third metacarpal bone from the right fore foot and fractured it in the center. Boiled the distal half for 10 minutes and then placed it in apposition with the normal half in the muscles of the left side of the spine.

Gross examination. 41 days. The two fragments were found to have separated. The distal boiled half was larger but more friable than the proximal half. The ends of the fragments are pointed and show no gross evidence of proliferation.

Microscopical examination. There is some cartilaginous and osteoid callus at the end of the live fragment, which does not completely bridge the gap between it and the boiled segment. There is no evidence of proliferation from the boiled bone.

Experiment 31. Duration 41 Days. Dog 15, Growing

Operation. Removed the fourth metacarpal bone from the right fore foot, and after fracturing in the center, boiled the proximal one-half. The two halves were then placed end to end and transplanted into the muscles on the right side of the spine.

Macroscopical examination. The fragments were found in good position in the muscle. There appears to be some callus at the site of fracture, and at least a partial union.

Microscopical examination. There is a mass of new callus extending from the live segment toward the boiled bone. The boiled bone is devoid of normal nuclei, and there is no sign of proliferation.

Experiment 32. Duration 86 Days. Dog 12, Full Grown

Operation. Removed the fourth metatarsal bone from the left hind foot and fractured it in the middle. The proximal half was put into boiling water for 5 minutes. The boiled and normal halves were then placed end-to-end in the muscles on the left side of the spine.

Gross examination. 86 days. The bone fragments were found in the muscle. There was absolutely no sign of union.

Experiment 33. Duration 95 Days. Dog 13, Full Grown

Operation. Removed the fourth metatarsal bone from the right hind foot and after fracturing in the center, boiled the proximal segment for 5 minutes. The endosteum was curretted out of the other half. Then the two halves were placed together and transplanted to the muscles on the right side of the spine.

Gross examination. 95 days. The bones were found in the muscles of the back without any signs of union. The boiled fragment is smaller than the normal and appears to have undergone more absorption. The roentgenogram (Fig. 16) shows the marked absorption of the boiled fragment and a possible attempt at proliferation at the end of the normal segment.

Microscopical examination. There is considerable new osteoid and cartilaginous tissue about the end of the live fragment. There is absolutely no sign of proliferation about the dead fragment, in fact the picture is one of rapid absorption.

Experiment 34. Duration 113 Days. Dog 9, Growing

Operation. The third metacarpal bone of the right fore foot was removed and fractured in the middle. Boiled the proximal half for 5 minutes and after putting the two fragments together they were transplanted to the muscles on the right side of the spine.

Gross examination. 113 days. The bones have healed nicely in place. There appears to be definite union between the two fragments. The distal one-half is larger than the proximal boiled half, and is evidently more resistant. The roentgenogram (Fig. 17) shows definite osseous union at the site of fracture. The boiled half has undergone more extensive absorption than the live half, and is less dense.

Microscopical examination. A section through the bone at the site of union shows that it is entirely osseous (Fig. 18). This remarkable picture shows the live bone on one side with its finger-like projecting processes of new bone penetrating the dead boiled segment. With such clear evidence of independent activity, under such adverse conditions, it does not seem possible that there could exist any further doubt as to the independent reparative powers of

the osteogenetic cells of the transplant. There is absolutely no sign of any changes in the surrounding connective tissue. There is definite evidence of absorption of the live bone as well as of the boiled bone. There are several areas in the boiled bone that look like new osseous tissue of the heterogenous type, previously described in the experiments on boiled bone.

SUMMARY ON ONE-HALF BOILED AND ONE-HALF NORMAL BONE TRANSPLANTED INTO MUSCLE

Before considering the results of this series of experiments it is important to bear in mind the nature of the experiment. In the first place the bones are buried in muscle and thereby removed from any possible contact with other osseous tissue. In the second place they are not subjected to normal functional stimulation. In the third place one fragment has been killed by boiling. Even after the astonishing resulting union of two live segments under similar conditions, one at the most would hardly expect more than a slight proliferation at the end of the live segment. Now, when we find that after 113 days in one experiment a definite union of a live with a dead segment occurred, a considerable importance must be accredited to this independent power of growth possessed by the osteoblastic cells of bone after transplantation. In one other experiment there was beginning union, while in the three remaining observations in which the time was sufficient, there was a failure of complete healing of the fracture, but definite evidence of proliferation from the live segment in an endeavor to bridge the gap.

The live segment was more resistant to absorption than the dead half.

General Summary

1. Fractures in entire free bone transplants either when reimplanted or transplanted to the muscles of the back united in a similar manner to a fracture in a bone under normal conditions. The callus arose from the active osteoblastic cells of the transplant itself, without the aid of any other osseous tissue. In the removal of the bone, as the entire metacarpal or metatarsal, one necessarily destroys its blood supply. As the healing of the fractures takes place in spite of this destruction of the vascular supply, it seems as though one could not include injury to the blood supply as a cause of non-union in an ordinary fracture, where conditions are much more favorable for healing than in a transplant, especially when buried in muscle. The explanation of the cause of non-union, outside of those cases of malalignment and interposition of fibrous or muscular tissue between the bone ends, is most likely due to some deficiency of necessary chemical elements or lack of certain physiological stimuli.

2. Fractures in boiled bones, either when reimplanted or transplanted to the muscles of the back, showed no evidence of union or proliferation about the bone ends. Therefore, it cannot be contended that the callus-forming tissue arose outside of the bone of the transplants, as there was an equal opportunity for such an origin in the boiled as in the live bone. There was never any evidence of new bone forming in the boiled bone, except for an occasional very limited area in which the cells appeared fairly normal, which was possibly due to a better fixation by heat or real example of heterogenous bone formation. The boiled bone showed more evidence of absorption than the live bone after transplantation.

3. Fractures in transplanted bones in which one-half is boiled and the other half allowed to remain in its normal condition, either reimplanted or buried in the muscles of the back, will unite. This means that there is sufficient power in the osteogenetic cells of the live half to bridge the fracture gap and penetrate the dead fragment, thereby welding the live transplant to the dead transplanted bone.

4. It might be said, that just as nature abhors a vacuum so does it abhor a fracture and, therefore, makes every effort to repair such a lesion, under all conditions, in a definite, orderly, and purposeful manner.

CONCLUSIONS

1. Fractures in transplanted bone, even when buried in muscle, united firmly and in a similar manner to a fracture under normal conditions.

2. Fractures in boiled transplanted bone never united nor showed any signs of pro-

liferation or attempt at repair. Occasionally a small area resembling new bone was noticed on the surface, which bore no relation to the fracture and was possibly of metaplastic origin.

3. Fractures in transplanted bone, in which one-half was boiled and the other half was alive, even when buried in muscle under favorable conditions united. It is believed that this is the crucial test of the independent, inherent osteogenetic power of the cells of a transplanted piece of bone, and establishes beyond doubt the proof of this independency and furthermore shows an additional reparative property of these same osteoblastic cells.

(I wish to express my indebtedness to Professor Blaisdell for the privileges of the laboratory which were granted to me during this experimental work.)

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THE EFFICIENT SURGEON[1]

BY RAFFAELE BASTIANELLI, M.D., ROME, ITALY

I RECALL with great pleasure one evening 4 years ago when I had the great honor of receiving the diploma of fellow of this College from the hands of Dr. W. J. Mayo. I do not know really why this new honor of delivering the Fellowship Address should have been conferred upon me, unless because your Director General knew that I have infinite spiritual ties and sympathies not only with the prosperity of the College but with the great ideals to which it aspires. This makes me feel that I am not a stranger among you, and gives me the greatest confidence in addressing you—which I am doing out of the fullness of my heart.

I had prepared a rather elaborate study on the statutes of some old Italian colleges, especially of the famous Medical School of Salernum, but being here among you I feel that your spirit is in the present, and that you are looking with keen eyes toward the future. So it seems to me the dust of the centuries is better left intact on the venerable shelves of the past.

Your institution in 9 years has accomplished gigantic results, and it is running at such a speed, that it is justifiable if your attention is dedicated to the immediate present, if not completely to the future. When I consider the greatness of such an institution capable of uniting both North and South America, the power it has obtained—a power achieved not only because of the number of fellows, because of its wealth, and its energy, but because of the noble aims to which you aspire—I am astonished and feel as if I were suddenly brought into the fairy land of human ideals. For, there is no doubt, that human ideals are better achieved by our profession than by any other on earth. In 9 years the College has already attained many of its purposes or ideals. I need not remind you of the work of the hospital standardization department which reports 83 per cent of the hospitals meeting the minimum standard of the College—a really incredible result—the abolition of the fee splitting, and other features destined to raise the medical standard higher than ever.

The beauty and the comfort of a hospital are great things. The laboratories, their equipment, the funds to keep them up, certainly make for great progress and give incredible facilities to the student, but what would all that mean if there were not present, spirits capable to give life to those inanimate things? The next project of the College will certainly be this: to raise the surgeons to a greater efficiency, and, why not, to try to create a standard surgeon?

[1] Fellowship address delivered before the convocation of American College of Surgeons, Boston, October 27, 1922.

This question is so deeply connected with that of the medical education, that unless you confront the one, you will not be in position to look even adequately at the other. For instance, the College elects its members after careful consideration: let me say that surely the selection will include the best. However, the College must select out of the material at its disposal. Is this material the best that medical education can produce? What can the College do to make it the best, and what can it do for the many who are not members?

These outsiders have a right to live, a right to exercise their profession, and more than that, they have the right to feel that there is a human, kind, supporting hand given to them with the best Christian spirit, to raise them, to make them better. None of us who has a more privileged position, can think of leaving in the struggle without help other colleagues who have families to support and patients to treat. The College, I am sure, will take care of such men, too, for they represent the lost sheep which the good shepherd should like more than the ninety-nine he sees around him.

The demand for doctors, in a large country like this, is enormous, and the ones who are scattered far away in remote sections should not be neglected, for they are fighting great struggles single handed. Did they start with the best equipment for the fight? Could they keep such equipment up to date as is necessary? Let me say that I have infinite sympathy for the country doctors and for the most humble of them, for I know their life well. Whether they be Fellows of this College or not, let me send to them the most hearty wishes, for I feel like a true brother to them. And the best wish is, that some day there will not be Fellows of the College and outsiders, but all will and must belong to it or not exist. And then perhaps there will be only one College, which, uniting surgeons, physicians, and specialists, will call itself the American Medical College. Such a great universal institution would not only be capable of taking care of all the medical men of this country, but perhaps look after the welfare of all the medical men of the world in communion with the Colleges of all the world, and would have the best authority to handle, not from the point of view of the surgeons, but of every medical man, the problem of medical education, better than many separate Colleges could do.

After all I am sure the true question is this: The good surgeon is the good medical man —and you will have good surgeons only if you can have good medical men. Certainly he must have a generous heart and a well-balanced brain, like that of any medical man, only he must have dexterous hands too, and the combination of the three qualities is not always easy to find. Though the hands be less dexterous or even not brilliant, they must be safe, and the very beginning of safety is knowledge.

How can we give this knowledge to the students during their school years, and how after graduation?

There is science and practice in medicine, and it would be just as unjust if the one or the other should prevail. Since the future doctor is the man who has to treat sick people, it is clear that all our efforts should be directed toward providing him with adequate practice guided by science. Science and practice in the school should aim not to fill the minds with innumerable facts or with innumerable observations, but with the principles themselves. Let me summarize them: the teaching of science to a student means the giving to him of such a scientific habitude of mind that he will feel the power of the science all through his life, so that he may see everything through it and with it, and apply it to the study of patients, and do nothing without it. The principles of practice could be summarized as follows: the teaching of students in the use of their fingers, their eyes, their ears; in learning how to observe and how to develop the habit of thinking.

Observation is a very rare quality: in the one student it is inborn, powerful, always active, leading to discoveries; in an other it is a hibernating faculty which can be beautifully developed by constant training, and even if not reaching the height of the inborn quality, may be made such as to enable every student leaving the school to be ready to use it in every occasion, and never to take any chance, but always be capable, as you say, to stop, look, and listen. Have you ever considered

the importance of these three words, and especially of the first? Take a chair if you are in a hurry, sit near the patient and you will be at once capable to see. And to listen to a patient, is it not the most difficult thing?

But it will be less difficult for the student if he learns by example from his teacher, who sits down and listens. Even in the most feverish chattering of the neurotic woman or in the lamentation of a hypochondriac, there is much to be listened to; I am deeply impressed by this sentence: the patient is always right.

Now the medical schools provide the students with magnificent laboratories, with men of true science, with instructors, patient and efficient. There is no excuse for us in the future: either the new generation will be superior, or our teaching is not right. The first thing to avoid in the school, if we are to escape reproaches, is that we must stop splitting up the big tree into smaller and smaller branches, lest the connections with the tree shall be lost. I speak of obligatory teaching, not of facultative teaching, and less of practice. For I believe we have to let everybody be free to practice whatever part of medicine and surgery he wants, and every school free to enlarge facultative teachings: but we should never compel the student to hear of all those things separately: he should see them presented by the general clinical teacher under one heading and in their real relation with the whole of the patient, not as diseases pertaining to a separate detached portion of the body. Perhaps anatomy and physiology, as our honorable president thinks and teaches, should always be connected with the human sick body during the school years if we want them not to be crude and dry memory efforts, but living and inspiring foundations for clinical practice.

Besides this general question, we could discuss at length the single matters to be taught, such as the place to give to pathological physiology versus pathological anatomy, the importance of laboratory work, the necessity of not believing that the only surgeon will be the research surgeon, and so many other details. Let me say that I believe deeply in the necessity that the student should be trained to see the anatomical structural changes in the organs he is examining clinically, as if he had them in his hands: whatever may be the importance of thinking physiologically, the most the average surgeon needs is to recognize anatomical lessons, for he is the pathologist of the living.

To encourage the students to do research work is commendable. But as it would be useless to give music lessons to every boy, so it is of research if extended to students in general. The man who has the impulse of research will find his way even in the most adverse circumstances, and even in the most desolate surroundings, like Magendie, Claude Bernard experimenting in a cave, Pasteur doing all his early work in one room which he would clean as he had to clean all his glasses and instruments.

The research mania is still worse when it has the scope of creating pseudo-scientific papers and futile experiments, many of them unhappily as a means of advertising. The average surgeon will better dedicate his time to other studies unless an interior force pushes him to the research laboratory. After all, no laboratory, no monumental building will change what the thousands of years have proved to be true, that only few men possess the lighting flame of discovery. Their influence lasts for years more or less, during which all the others are working along their ideas: let them be called contributors, modifiers, elaborators, they are a crowd destined to disappear. Humanity looks at the high peaks, and even if now and then a lower mountain may attract the attention, certainly the sun will shine until the last minute only on the high snow-clad summits.

I do not wish you to interpret that I am diminishing the importance of the research work. Quite on the contrary: for no real progress is made unless based on scientific foundations even remote and indirect. I mean only to caution against the tendency to urge the whole mass of students to attempt laboratory research rather than clinical investigation, as if they could do something good. That is impossible. But the clinician certainly can and should inspire research

work, and be able to go into it if necessary, for generally the clinical investigations reach a dead point after a while, and cannot be animated but for the life coming from science. Research for clinical purposes, and the pure science cannot be put on the same level: every student should get well acquainted with the first, and only a few with the latter.

And now let us take the young man who has the habit of thinking scientifically, and let us teach him how science works at the patient's bed. He will soon learn the importance of that, if we can train him first to do all the minor work of medicine and surgery, in its least detail, say, as if he should be a trained nurse. Let us teach him by experience on the living how a drug does work in the pathological conditions of the human body, let us teach him physiology and anatomy under the light of the morbid condition of the single individual and of the treatment, let the teacher inspire him with broad views of subjects from a general point, and soon he will be able to understand the major problems and to think of them with his own brain. To reach that scope the American College could well take steps. Is such teaching now materially sufficiently done? I mean, inasmuch as there are beds and the instructors provided for each student. And as I suppose, if it is numerically not enough, do you think that it would be good to enlarge the clinical department of the school so that one man would lead such a large institution, or do you think that it would be far better to extend to other men, having charge of first-rate hospitals, the privilege of teaching? What a spirit of noble competition would be created and how much easier, inexpensive, and liberal it would be: for it would train properly so many more doctors, and a smaller number of them would need postgraduate work, if they were obliged to enter directly into practice.

Next to the student question comes the one of the future surgeon. Even the best teaching during the school years cannot create a good general surgeon. "To frequent societies, to visit clinics and libraries, to own valuable instruments or valuable books, to publish papers in journals, does not contribute in the least to the comfort of the sick," said Baglivi, an illustrious Italian physician of old times.

At the present state of our art and science nobody can be allowed to be a self-made man in surgery: he must necessarily have the inheritance from his predecessors to thrive on and to add to. This is only possible by compelling anybody who will be only surgeon to enter into hospitals and clinics, and to serve for a certain period of time and to give a final proof of his capabilities. It seems hard to have to stand, later in life, such an ordeal, but I believe it extremely necessary if we are to avoid the unconscientious surgeon tackling difficult cases only because he has acquired, say, the instruments Dr. X. is using, or the catgut and needles seen in Dr. Y's clinic. The general practitioner, the one who is usually confronted with surgical emergencies, should know how to recognize them first, and to attend to them only if immediately necessary. For if time allows he had better send them to safer hands.

In thinking of the position of the general practitioner I am reminded of the sixteenth century statute of an Italian town which said that "people not belonging to the College and wanting to practice surgery, either being citizens or foreigners, should be diligently examined by the College, who will give to him as much authority to practise as the College will recognize him capable. But in wounds, ulcers, and dangerous apostematas he will be obliged to join a fellow doctor."

This will never be possible in our times and with our degrees. To promote consultations, to persuade the practitioners that it is their deep duty never to leave a responsible case without the help of a colleague if available, and that help will not be a diminution of their authority, can be a good aim of the College. I believe that the time will come when the College will be able to enforce the rule that every general practitioner should have, after a certain time, say for example, 3 years, a course of at least 2 months' duration, in which he could see the new things, remember and review the old ones and have practical instruction in the wards in the operative theater. Perhaps the day will come when also the general surgeon who has not a

hospital appointment may be compelled to have a course after so many years. All these suggestions seem to me appropriate to the circumstances and perhaps worth some consideration.

The world owes much to America in matter of surgery. Let us hope that the men of the next generation may say that America created the standard surgeon.

I have great faith in the future of the surgeon and am even deeply persuaded that the man endowed with a brain full of initiative and scientific capabilities, with a generous heart and with wonderful hands will be always an exception, the average surgeon will appear as a man capable of performing his duties not only with his hands but with full knowledge of his responsibilities, and what is more important with complete conscience of his possibilities.

I would have liked very much to project some diplomas of the Salernum school dating from the middle of the sixteenth and seventeenth century, and to illustrate them in completing my address. As it is not possible to do this, let me quote only how one of the texts ended: "We Rector and Fellows of the College have with solemn ritual attended to his Degree: we have put in his hands a closed book and then opened it, on his finger the ring, on his head the crown, and each one of us having as is customary kissed him in the church of Saint Catherine, we have accompanied him home with our best wishes." Do you remember how Longfellow rendered it?

> Having faithfully promised these,
> His head is crowned with a laurel crown;
> A kiss on his cheek, a ring on his hand
> The Magister Artium et Physices
> Goes forth from the school like a lord of the land.

We have no more of those symbolic formalities. Nobody has put the book in your hands, neither the ring on your finger, and certainly not the crown on your heads. *But you have made some promises!*

Let me wish to all of you, new and old Fellows, that at the end of your career, you may look back at those promises and see that you have fulfilled them, and that, in the last days, you will smile quietly, for you will feel that all your life is being crowned in that moment, by a better and a stronger power than that of any College of Surgeons, than that of any other power on the earth—by the power of your conscience.

THE PATHOLOGICAL ANATOMY OF "AUTOINTOXICATIONS" IN PREGNANCY AND CHILDBIRTH

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IN pregnancy and during childbirth there not infrequently arise severe and even fatal diseases the pathogenesis of which is obscure and disputed. It may concern convulsions, icterus and albuminuria, severe vomiting, and neuritis as well as cutaneous symptoms. The conception of the nature of these conditions varies greatly. Puerperal eclampsia has long been regarded as an intoxication, but concerning the nature of vomiting of pregnancy, neuritis, etc. there is great difference of opinion. The fact that these conditions seem to be related through transitional forms may be said to point to a common etiology, and the anatomical changes in these conditions also indicate that they are related, even if subject to manifold variations. In the course of years I have had occasion to make many postmortem examinations of patients from the gynecological clinic of the Rikshospital (Professor Brandt) who have died with symptoms of the kind in question, and I have thought that it might be of interest to review this material particularly from the anatomical point of view.

GROUP I.—PUERPERAL ECLAMPSIA

The pathological anatomy of puerperal eclampsia is quite typical and may be described briefly as follows: The kidneys are acutely and violently degenerated, being pale, yellowish white in color, but as a rule there is no acute or chronic nephritis except as occasional complications. The degeneration may vary in degree; sometimes there may be hæmorrhages, oftener one meets with necrotic, infarct-like areas and also small hyaline thrombi in the vessels. The pelvis and ureters are, as a rule, free from changes. Usually the liver shows the most characteristic and, one might say, almost pathognomonic changes—it is degenerated, soft and flabby, pale, with an icteric tinge, with transitions toward acute yellow atrophy. Perhaps the most characteristic feature is the so-called hæmorrhagic infarcts, which consist of sharply circumscribed, irregular, usually red areas on the surface of the liver that extend into the substance for a distance, and are infiltrated with blood in places. Microscopically such infarcts show an extensive necrosis or degeneration of the liver cells, dilatation of the portal capillaries and more or less hæmorrhagic infiltration; the capillaries may be thrombotic and filled with hyaline masses, the contours of red corpuscles being perhaps recognizable. Such changes in the liver may vary greatly in intensity and do not correspond to the intensity of the convulsions.

The spleen does not show any special changes; the lungs may be hyperæmic and œdematous, sometimes showing small hæmorrhages, and occasionally liver cells and giant cells are found in the small blood vessels; in the central nervous system may be found punctiform hæmorrhages and occasionally large fatal cerebral hæmorrhages occur even when the blood vessels appear to be normal; the heart muscle may be degenerated with subepicardial hæmorrhages, and the blood often is laked more or less; in the genital organs the conditions as a rule are normal without signs of infection.

Some stress has been placed on the emboli of cells found in different organs; liver cells may be found in the blood, the myocardial and pulmonary capillaries, also giant cells from the placenta and even chorionic villi.

While the anatomical picture, especially the hæmorrhagic infarcts in the liver in connection with the degeneration of the kidneys, is more or less pathognomonic, typical eclampsia may be associated with rather indefinite and not well-marked degenerative changes which resemble those found in other forms of so-called autointoxication, and such cases (without convulsions), in turn, may be associated with anatomical changes such as are seen in typical eclampsia. A few illustrative instances follow.

GROUP 2.—ECLAMPSIA WITHOUT CHARACTERISTIC ANATOMICAL CHANGES

CASE 1.—Primipara, age 27, gave birth to full-term child whereupon an eclamptic attack developed followed at intervals of 3 to 4 hours of in all 25 definite attacks of tonic and clonic convulsions with deep coma. Chloral, morphine, and blood letting had no effect. Death occurred after about 48 hours with rising temperature. The lungs showed a double bronchopneumonia; the heart seemed rather large, flabby, with subepicardial hæmorrhages, muscle yellowish; the uterus, characteristic of the puerperal state, was otherwise free from any changes, but there were thrombi in the internal spermatic vein, pudendal and uterine plexuses; the spleen was soft and enlarged. The kidneys were large, smooth, with swollen cortex with indistinct markings, pelvis normal, and microscopically there was parenchymatous degeneration in the convoluted and straight tubules, but no nephritis. The liver weighed 1850 grams; pale yellowish white in color and of the usual consistency, the surface showing only one or two small rather indefinite hæmorrhagic infarcts, and microscopically the epithelium was markedly degenerated in places, but there were no hæmorrhages. There were no changes in the brain; leptomeninges injected and œdematous.

Summary. In this case the principal changes were degeneration of the liver and kidney with poorly developed hæmorrhagic infarcts in the liver. The alterations in the liver were insignificant in comparison with the violence of the eclamptic symptoms.

CASE 2. A woman, age 20, died of eclampsia having had diplopia and headache for a few days. At the autopsy the uterus contained a fetus about 30 weeks old. The liver weighed 1490 grams, surface smooth and shining, pale reddish brown in color; numerous capsular hæmorrhages not extending into the tissue of the liver, which microscopically appeared to be quite normal in structure except that the portal branches were greatly congested, but there were no thrombi and no hæmorrhagic infarcts, the cells adjacent to the veins being somewhat degenerated, and evidently an œdema had developed about the veins. Heart normal; spleen small. Left kidney small with a scar on the surface, the cortex broad and swollen; right kidney weighed 160 grams, smooth and shining on the surface, cortex pale yellowish brown, 8 to 10 millimeters in width, with distinct markings; microscopically there was some hyperæmia and marked degeneration of the epithelium in places in the convoluted as well as the straight tubules, but no nephritis. Other organs were normal except that in one adrenal were a few small hæmorrhages with a little necrosis in the cortex.

Summary. This was a typical eclampsia developing in pregnancy, but without the characteristic anatomical changes as there was found only an acute degeneration in the liver and kidneys as well as necrosis and hæmorrhages in one adrenal. There were no hæmorrhagic infarcts in the liver, but the dilated vessels and the early œdema may be regarded as a beginning infarction.

GROUP 3.—INTOXICATIONS WITHOUT CONVULSIONS BUT WITH THE ANATOMICAL CHANGES OF ECLAMPSIA

CASE 3. A primipara, age 41, expecting confinement in March, 1921, entered the clinic March 8; she was pale, but fully conscious, with albumin and pus in the urine; on the same evening she gave birth to a dead fetus weighing 1500 grams; there was a hæmorrhage of about 500 grams and the placenta was delivered easily soon afterward; the patient died suddenly next morning with stertorous breathing.

In the left frontal lobe was a large hæmorrhage, containing a clot about 12 centimeters long, the gyri were flattened, the sulci small, but otherwise the brain was normal. No icterus; no gas emboli in the heart and no emboli in the lungs; the heart weighed 290 grams, there were some hæmorrhages under the endocardium of the left ventricle, and along the line of closure of the mitral valve were small warty excrescences containing gram-positive diplococci; the respiratory organs showed no changes; there were no signs of any infection in the genitalia; the spleen was small and weighed 120 grams. The kidneys weighed 310 grams, were smooth on the surface and pale yellow in color, the cortical markings were distinct; microscopically the only change was degeneration of the renal epithelium, especially in the convoluted tubules. The liver weighed 1770 grams, was smooth on its surface. The larger part of surface of right lobe and here and there of the left lobe presented large, intensely red areas or irregular spots, but the redness did not go down very much into the substance which was pale, yellowish white, with fairly typical markings, and microscopically there was found here and there rosette like necrotic areas in the periphery of a series of adjacent acini, the necrotic districts being sharply defined, irregular in outline, like a network with small spaces, the bile capillaries in these areas being widened and filled with blood or a red homogeneous material, while surrounding the necrotic foci the liver tissue was degenerated and filled with fat and pigment granules. The stomach and intestines showed no changes.

Summary. The lesions correspond well to the picture of eclampsia parturientium, especially as regards the liver, and the cerebral hæmorrhage was such as may occur in eclampsia and cause death quickly, but clinically there were no convulsions, consequently no eclampsia.

CASE 4. A primipara, age 21, entered the clinic February 22, 1922, in the fifth or sixth month of pregnancy. She had had headache, œdema of the legs and black shadows before the eyes for some days before and about 2 days before she had a convulsive

attack. The temperature was normal; eye grounds normal; the urine contained albumin and pus, hyaline casts and red cells; and the legs were œdematous; blood urea 0.4 per cent, blood pressure increased. March 30 a girl about 30 weeks old was born; about 800 cubic centimeters of blood was lost and some 30 hours later the patient became pale, restless, more or less collapsed. In spite of camphor and caffein the general condition remained unsatisfactory during the subsequent days when vomiting set in, the vomitus containing blood; there now appeared also attacks of dyspnœa, but the senses remained clear and there were no convulsions; gradually the dyspnœa became worse and death occurred April 1.

Postmortem the heart, which weighed 235 grams, presented numerous subendocardial and subepicardial hæmorrhages, the muscle being pale; except for subpleural hæmorrhages and some œdema, the lungs were normal; thyroid and parathyroid glands normal; spleen small, weight 55 grams. Liver weighed 1470 grams, the surface was highly mottled; the apex of the left lobe presented an elevated area, 8 by 6 centimeters, quite firm, pale yellow with red specks and areas, sharply defined but without definite hæmorrhagic infiltration, there being also smaller yellowish areas elsewhere in the left lobe; along the right border of the right lobe was an infarct-like district of the same appearance as in the left lobe while the entire under surface of the right lobe showed many small infarct-like districts. The pancreas was normal, weight 67 grams. Kidneys weighed 280 grams, capsules free, surface yellowish, cortex narrow but markings distinct, pelvis and ureters normal, but microscopically the urinary tubules were everywhere filled with a granular mass containing epithelial cells and leucocytes, and fat stains showed much fat in the epithelium throughout the kidneys as well as in the endothelial cells. Adrenals normal; some hæmorrhagic erosions along the minor curvature of the stomach; intestines normal. The uterus and other genital organs showed no signs of infection or unusual appearances and the brain and its membranes looked normal. Microscopically the infarct-like areas in the liver showed a complete necrosis of numerous acini in some places and a partial necrosis in others, the necrotic epithelium being filled with small, fat granules and bile pigment, while at the periphery there was either congestion or hæmorrhagic infiltration with leucocytic accumulation; there were no thrombi or emboli in the small branches of the portal vein and there was no fibrin precipitation at the peripheries of the acini; in the larger branches of the portal vein the coagula contained numerous leucocytes filled with fat granules.

The child lived 9 days and weighed 1270 grams; there were numerous rather extensive hæmorrhages in the lungs and over the surface of the heart and kidneys.

Summary. It is noteworthy that except for the marked fatty degeneration, the kidneys were normal, while the liver in every way corresponded with the liver usually seen in eclampsia. It is true that the patient had a convulsion early in pregnancy but death occurred under a different picture than that of eclampsia.

CASE 5. A woman, age 51, who had had six children, suffered nausea, vomiting and headache toward the end of the second month of pregnancy; mental symptoms supervened, the vomiting increased and at the end of the third month a hydatid mole was removed with the placenta, followed by death 24 hours later. The kidneys were pale, yellow white and degenerated, and the liver, which weighed 1080 grams showed numerous, small, sharply defined, red spots under the capsule, the cut surface being yellowish brown and the parenchyma friable. Microscopically there were fat changes in the renal epithelium, the nuclei of which stained poorly, the stroma and glomeruli being normal; the liver showed no inflammatory changes, marked fatty change in the liver cells, which also contained green pigment, congestion of the portal capillaries at the periphery of the acini with hæmorrhagic extravasations and some necrosis of liver cells. At the placental site were the typical structures of hydatid mole, but no signs of chorio-epithelioma.

Summary. The appearance of the liver resembled somewhat that in eclampsia and the case forms a transition between eclampsia and other intoxications so far as the anatomical changes are concerned.

Here may be mentioned a case illustrating eclampsia-like conditions in pregnancy, but with no relation to true eclampsia or other similar intoxications.

CASE 6. A woman, age 39, was attacked by convulsions in the third month of pregnancy, which occurred again at different intervals; when she entered the clinic in the tenth month she was unconscious and convulsions set in, which became more and more severe, death occurring in coma. There was a right facial paralysis and the positive Wassermann reaction of the blood as well as the presence of mononuclear cells in the arachnoid fluid led to the suspicion that cerebral syphilis was present. The postmortem examination showed syphilitic aortitis, granular ependymitis and a microscopically typical meningo-encephalitis; the heart muscle, the liver, and the kidneys showed some degeneration. It would be most reasonable to ascribe the convulsions in this case to the meningo-encephalitis.

GROUP 4.—AUTOINTOXICATION IN PREGNANCY AND CHILDBIRTH THAT CLINICALLY APPEARS AS RENAL DISEASE AND ANATOMICALLY AS RENAL DEGENERATION

CASE 7. Woman, age 38, developed œdema and albuminuria in the last month of the second pregnancy. When she entered the clinic she was pale,

cyanotic, and had high blood pressure and severe albuminuria. Cæsarean section was made (Dr. Sunde) and full-time twins were delivered; the cyanosis and œdema increased and the patient died the following day. The postmortem examination showed, as the main changes, some enlargement of the kidneys, which weighed 350 grams, and were pale yellowish white, soft, with indistinct markings; microscopically the epithelium, especially in the convoluted tubules, was markedly degenerated and contained many fat granules, nuclei not demonstrable, but the glomeruli were normal and there were no signs of inflammation in the kidney. The liver was not enlarged, was rather soft, and microscopically there was a good deal of fat in the cells in the periphery of the acini.

Summary. The degenerative changes in this case must be regarded as the expression of an "autointoxication"; it is noteworthy that the renal degeneration seemed to predominate clinically as well as anatomically.

GROUP 5.—AUTOINTOXICATION IN PREGNANCY AND CHILDBIRTH IN WHICH DEGENERATION OF THE LIVER PREDOMINATED

CASE 8. Primipara, 37 years old, entered the clinic in the eighth month after having had headache and vomiting for about 8 days. She seemed confused, there was mild icterus present, also cyanosis, and as these symptoms all increased the head was perforated and the fetus extracted. Complete anuria developed and she died the following day. The kidneys were large, weighing 380 grams, and soft, the cortex pale; microscopically there were no inflammatory changes but a marked albuminous degeneration with but little fat. The liver was small, weighed 1410 grams, was soft, markings indistinct, color throughout pale yellow. Microscopically the liver cells were degenerated, but there were no inflammatory changes. In the right ventricle were rather loose thrombi, and in the lungs were emboli with some hæmorrhage in the corresponding tissues but no definite infarcts. There was some icterus.

Summary. In this case the liver was the seat of the most marked changes.

GROUP 6.—HYPEREMESIS GRAVIDARUM

CASE 9. Primipara, age 25, suffered from vomiting since about the second month and entered the clinic in the third month on account of continued severe vomiting; a few days later she became almost blind and the uterus was emptied, but the condition became worse and she died 48 hours later. The postmortem examination showed no special changes in the heart, spleen, or central nervous system; the liver was rather yellowish and somewhat degenerated, but there were no hæmorrhages or infarcts and the microscopic sections showed no inflammatory changes, no necrosis or hæmorrhages, but some fat in the liver cells the nuclei of which stained well; the kidneys showed a marked pale yellow, degenerated and swollen cortex, and under the microscope the epithelium of the convoluted tubules was changed into a structureless mass without any stainable nuclei, but there were no signs of acute or chronic nephritis.

Summary. A pronounced case of vomiting of pregnancy with so marked degeneration in the kidneys that it cannot be explained merely as the result of inanition.

CASE 10. Woman, 22 years old, entered the medical clinic on account of "dyspepsia" and vomiting; the vomiting persisted until she died about 3 months later; the day before she died, a vaginal hæmorrhage appeared and a fetus 12 centimeters long was expelled. The postmortem examination showed an extensive parenchymatous degeneration in the liver and kidneys while in the stomach there was nothing abnormal to be seen and no ulcer; the liver weighed 1250 grams, was yellowish in color, soft, no hæmorrhages or infarcts, and microscopically there was found a severe fatty change; the kidneys were pale yellow, soft, with indistinct markings and severe degeneration of the cortex but no inflammation.

Summary. Undoubtedly this was a case of vomiting of pregnancy with severe degeneration in the liver and kidneys.

GROUP 7.—AUTOINTOXICATION IN PREGNANCY AND CHILDBIRTH WITH THE PREDOMINANCY OF NERVOUS SYMPTOMS

This may concern neuritis, especially of the optic nerve with blindness, due to degeneration of the nerve rather than a real neuritis. Schioetz[1] has emphasized the frequency of papilloretinitis in pregnancy, particularly in women, who have chronic nephritis but also in women without any definite clinical signs of nephritis, and he has emphasized too the occurrence of amaurosis without anything abnormal in the eye grounds either ophthalmoscopically or anatomically; at times detachment of the retina, œdema, hæmorrhages were found by him, however, in eclampsia and also in "threatened eclampsia," that is to say in intoxications without eclampsia, the condition in which we are interested especially. Of other nervous symptoms may be mentioned the frequent neuralgic pains, polyneuritic phenomena, chorea, etc. Nervous disturbances occur especially in eclampsia and excessive vomiting of pregnancy, and the anatomical substratum for these disturbances is not well known and has not been given

[1] Ueber Retinitis Gravidarum u. Amaurosis Eclamptica. Klin. Monatsbl. f. Augenheilk., 1921, Beilage heft.

much study. In addition we have different forms of mental disturbances, such as puerperal mania, confusions, etc., that also may be looked upon as manifestations of intoxications, and in which may be found degenerative conditions in the liver and kidneys. Such cases are of medicolegal interest because the patients may conceal the birth and kill the fetus while mentally disturbed and really not responsible for their actions.

DISCUSSION

The most important anatomical changes in these conditions are degenerations in the liver and kidneys. As a rule these changes are pronounced, without being specifically characteristic, being present in cases of eclampsia both those that do not have infarcts (see Group 2) as well as those that have more or less well-marked infarcts in the liver. Cases 3, 4 and 5 (Group 3) showed hæmorrhagic infarcts, but no eclampsia, and on the other hand Case 2 is a typical case of eclampsia but with indications only of beginning infarct formation in the liver, the other changes being of the same kind as seen in other forms of toxicosis. Furthermore there may be hæmorrhages in different organs just as in eclampsia; in Case 3 there was a cerebral hæmorrhage quite similar to that not infrequently found in eclampsia. Case 2 is interesting because of the necroses and hæmorrhages in the adrenals, the case being one of eclampsia without infarcts.

At times the changes in the kidneys may dominate the picture (Case 7, Group 4), while at other times (Case 8, Group 5), the liver degeneration may be the most pronounced lesion. The cases of excessive vomiting of pregnancy (Cases 9 and 10) are of special interest; degeneration of the kidneys was the most marked in Case 9, but both liver and kidneys were involved and there were present the symptoms of amaurosis without retinitis. In a few cases of hyperemesis, acute yellow atrophy of the liver has occurred.

Viewed as a whole the cases present all possible transitions from genuine eclampsia, with or without characteristic anatomical changes, to the different other groupings. The anatomical picture in the different forms to a certain degree is similar, even if there are many variations, and it lies near at hand to think of all these cases as similar in etiology and like eclampsia as due to autointoxication. In this connection it is of interest to recall the similarity of the cases under discussion with phosphorus, arsenic, and mushroom poisonings.

The syndromes and the lesions of the autointoxications under consideration are probably not due to infection. Splenic swelling as a rule is absent and as pointed out in the foregoing, the genital organs may be free from all signs of infection. Purely mechanical pressure by the uterus cannot explain the conditions; the occurrence of hyperemesis in the early months speaks directly against any such supposition. That they are due to uræmia in nephritis hardly seems possible because in so many cases, probably in the majority, the kidneys show no nephritis but only degeneration, pure and simple, but sometimes so pronounced that the nephrosis dominated the picture. The old theory of Traube-Resenstein to the effect that the cause of eclampsia is cerebral œdema and anæmia certainly does not fit the other forms of pregnancy intoxications, and it is to be noted that it does not explain the characteristic lesions in eclampsia, and finally we have the fact that as a rule there is no cerebral anæmia and œdema in eclampsia. The idea that certain forms of disturbances in pregnancy and hyperemesis are due to reflex irritation or purely hysterical in nature has been expressed, but the severe degeneration of the liver and kidneys, including the infarcts, cannot be explained as due to reflex neurosis or to inanition from excessive vomiting. It is well known that definite changes are found in the organs of internal secretion in pregnancy; the thyroid gland undergoes hypertrophy and appears to secrete more actively than usual; the parathyroid glands present proliferation of the chromophile cells; the chief cells of the hypophysis also increase, and this is true of the cells in the adrenal cortex too; and then there is hypertrophy of the mammary gland and the growth of corpora lutea in the earlier months. Are these changes primary and the cause of the intoxication or are they rather the result of a general

intoxication to which all organs are subject in pregnancy and which perhaps arises in the placenta and the fetus? So far as the mammary hypertrophy and the growth of the corpora lutea are concerned, there can be no doubt of their dependence on the fetus and the placenta, and it seems to me that the best hypothesis for explaining all these different disturbances in pregnancy would be that they are due to pregnancy intoxications. It has been suggested that disturbances in the metabolism of the mother may result in acidosis, but in this case the fundamental cause may still be some form of intoxication. The fact that eclampsia may develop in cases of hydatid mole in which the fetus has been completely absorbed, and the fact that in eclampsia the fetus may show similar changes as the mother suggest that the fetus itself hardly is the source of the intoxication. May not the placenta itself be the source? The epithelial layer of the chorionic villi, usually believed to be of fetal origin, is a secretory organ that independently acts on the material that passes through and it is not unlikely that the supposed toxic substances may arise here. The main results of these brief considerations is that the symptoms and lesions of eclampsia and other disturbances that have been considered are best explained as due to autointoxications, which may originate in the placenta, but the exact nature and mode of action of which we do not now understand. While it is not known that all the disturbances in question are of the same nature, the clinical phenomona differing greatly, still the anatomical changes are more or less similar and present so many connecting transitional forms as to indicate a more or less common etiology.

UNILATERAL INTESTINAL EXCLUSION

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INTESTINAL exclusion in its different forms and varieties is an operation frequently indicated in abdominal surgery. This operation was performed the first time by Trendelenburg, in 1885. Some years later, in 1888, von Hacker recommended it in cases of adhesions and fistula of the intestine, and, in 1891, Salzer published a paper reporting some cases of inflammatory tumors of the cæcum in which he had used it instead of resection. Hartmann made a very complete study of its different varieties, and von Haberer under the direction of von Eiselsberg and basing his opinion on a great number of experiments on animals and on clinical experiences, gave the rules for its use and described the technique as followed by most surgeons.

According to these reports, the operation more often used is the entero-anastomosis of Maisonneuve and its modifications, all of which procedures produce only partial exclusion of the diseased bowel, or bilateral exclusion, with one or both ends of the excluded bowel in communication with the skin.

Unilateral exclusion, that is the procedure by which the gut is completely divided and the proximal end implanted into the side of the distal end, is very seldom used; in fact, most of the surgical textbooks, especially the American and English, for various reasons, do not recommend this method.

Warbasse[1] says: "In unilateral and bilateral exclusion, the excluded ends should be brought out as intestinal fistulæ for drainage. Exceptions may be made to this, but it is the safest practice. The only part of the intestine where regurgitation is not apt to take place is at the ileocæcal valve."

Moynihan[2] says: "The conclusions to be drawn from the evidence furnished both by experimental work and by experience of cases in man is that unilateral exclusion of the small intestine offers no advantages over entero-anastomosis, and in the large intestine does not prevent, at any rate for more than a short period of time, the backward flow of fæcal matter. Unilateral exclusion, save cases of disease affecting the lower end of the ileum, offers no advantages over lateral anastomosis."

"Unilateral exclusion[3] is open to an insuperable objection, rendering it a method unfit for recommendation. It will easily be seen that, in order to make the end of the proximal part of the bowel approach the point of implantation, a gap will exist below the mesentery of the implanted part, through which it will be easy for coils of intestine to pass, making obstruction an easy accident. It is far better, therefore, to make a side-to-side anastomosis instead of an end-to-side apposition."

As we see, there are two serious objections to unilateral exclusion. One is that it exposes the gut to internal strangulation; the other is that it does not exclude because there is always regurgitation and that, therefore, it has no advantage over simple entero-anastomosis. I cannot understand the first objection. In every entero-anastomosis, a gap is formed through which coils of intestine may pass, and consequently produce internal obstruction, if the gap is not closed carefully by suture. There is no difference in the results in this connection between unilateral and bilateral exclusion and very little difference between unilateral exclusion and simple entero-anastomosis. The importance of the second objection depends upon the indications for operation. If exclusion is done to close an intestinal fistula, and there is a backward flow of fæcal matter, of course the fistula will not close, but in this particular also there is no difference between the results obtained with simple entero-anastomosis and unilateral exclusion. Bilateral exclusion would be worse still, because then the surgeon would be

[1] Surgical Treatment, ii, p. 677.
[2] Abdominal Operation, ii, pp. 200 and 202.
[3] Keen's Surgery, iv, p. 725.

obliged to avoid closing of the fistula, or else his patient would be exposed to fatal consequences. It is true that in animals total exclusion of a part of the bowel has been done in some cases with good results; it seems that in the normal intestine secretion and absorption hold the balance, so that there are no bad results. But in pathological cases conditions are different, and Wiesinger has published a case where a coil of intestine which was totally excluded for a period of 17 years suddenly caused a mortal peritonitis by perforation. If the operation is done for a total or partial occlusion of the bowel (cancer, tuberculosis, or inflammatory tumor), of course, bilateral exclusion is the only procedure which gives the diseased bowel a complete rest, but it has the disadvantage of leaving an external fistula. Unilateral exclusion, even accepting the backward flow, has a definite advantage over entero-anastomosis, because in the latter some part of the contents is always pushed by peristalsis through the strictured area, while in the former the backward flow does not make a special effort to move the obstacle.

With these considerations as a basis and in spite of the above mentioned opinions of celebrated surgical authorities, I have tried unilateral exclusion in a number of cases, and the results, both primary and definite, have been favorable. I am giving below the details of some of these cases, as I think my results may be of interest and may induce other surgeons to give the method a trial. If their results are satisfactory their opinion regarding the operation, which now seems fixed, may be changed.

CASE 1. H. A., male, 26 years of age, entered the hospital January 1, 1915. He had symptoms of partial intestinal obstruction and presented a palpable tumor in the cæcal region. His age, the presence of symptoms of pulmonary tuberculosis, and the insidious evolution of the disease led us to make a diagnosis of ileocæcal tuberculosis. The operation, performed on January 4, confirmed the diagnosis. There was an intense infiltration of the surrounding tissues which made a resection impossible. I decided to do a unilateral exclusion. I cut the ileum some distance from the valve, closed both ends, and implanted the oral end side to side into the transverse colon. Recovery was uneventful and the patient left the hospital one month after the operation (February 4, 1915) greatly improved. He has done well since and is clinically healed. (September, 1922, 7 years after the operation.)

CASE 2. M. L., male, age 20, entered the hospital September 22, 1916, was operated upon the next day with a probable diagnosis of subacute appendicitis. The operation revealed an ileocæcal tuberculosis and tuberculosis of the appendix. As the result in the former case had been so satisfactory I did not try a resection, but did an appendectomy and unilateral exclusion with side-to-side implantation of the ileum into the transverse colon. Patient left the hospital 3 weeks after operation and has done well since.

CASE 3. Juan A., male, age 32, entered the hospital November 17, 1916, and was operated upon November 23. Tuberculosis of the small intestine with 5 circular tuberculous infiltrations within 1½ meters. After revision of all the bowel, the intestine was sectioned above the highest stricture and implanted side-to-side aboral of the lowest. Recovery was uneventful and patient left the hospital December 5.

CASE 4. Herminio M., male, age 21, entered the hospital August 8, 1917. Case very similar to Case 1. Patient was operated upon August 11 and left the 27th. Was doing well 2 years later.

CASE 5. Enrique E., male, age 32, entered October 16, 1917; was operated upon the 22d. Tumoral ileocæcal tuberculosis for which unilateral exclusion with implantation side-to-side of ileum in transverse colon was done. December, 1919, he was clinically healed.

CASE 6. Mercedes R., hospital nurse, age 23, entered the hospital September 11, 1919. A year ago she had been operated upon in another hospital for peritonitis due to an acute appendicitis. For some time she had a fæcal fistula which closed later spontaneously, but she remained with pains and symptoms of incomplete intestinal obstruction. She was operated upon September 13. The operation revealed extensive adhesions throughout the cæcum and lower ileum; in several points the latter was contracted by narrow bands of adhesions. We decided to do a unilateral exclusion, so we cut the ileum oral to the adhesions and implanted it side-to-side in the transverse colon. Recovery was uneventful; patient left the hospital September 23 and has been well since and can fulfil all her duties as hospital nurse.

CASE 7. Clorinda J., female, age 60, entered the hospital April 25, 1920. She showed symptoms of intestinal obstruction which had been going on for some time and had become more intense lately. There was a palpable tumor in the right hypochondrium which the X-rays revealed to be situated in the hepatic flexure of the colon. The operation (April 28, 1920) confirmed the diagnosis. A big tumor, adherent to the liver and to the posterior peritoneum occupied all the hepatic flexure. Macroscopically it looked malignant. As extirpation in sound tissue was impossible, we did a unilateral

exclusion, implanting the ileum in the transverse colon. No complications followed, and the wound healed *per primam*. The patient slowly improved generally, and she left the hospital June 23. Two years after the operation she wrote that she was doing well and had no abdominal symptoms. It was an inflammatory tumor, most likely due to the gall bladder.

Case 8. Margarita G., female, age 46, entered the hospital May 17, 1922. She had been ill for some days with fever and pains in the region of the cæcum. There existed a deep infiltration in the right iliac region (the patient was very stout), and there were symptoms of incomplete intestinal obstruction. Operation was done the next day, May 18, with the diagnosis of appendicitis. On opening the peritoneum, we found a tumor occupying the ascending colon at about 10 centimeters from the cæcum; the cæcum itself looked normal. The tumor was adherent and infiltrating, and there was a number of swollen lymphatic glands in the mesentery. It looked very much like a cancerous growth and I decided to do a two-stage operation, doing in the first stage a unilateral exclusion. The ileum was sectioned and the oral end implanted side-to-side in the transverse colon. The symptoms subsided, the temperature returned to normal and on May 31 (2 weeks after the first operation) I decided to do the resection. But on opening the abdomen I found that most of the tumor had disappeared, and upon careful examination I could demonstrate that all the trouble was due to a very long retrocæcal appendix, with a perforation at its end and a consequent infiltration of the colon and the retrocolic space. I extirpated the appendix, but as patient has been feeling well, I left the ascending colon as it was. Recovery was uneventful; patient left the hospital July 28.

Of these 8 patients I have heard from Cases 2, 4, 5, and 7 and have been able to examine lately 3 (Cases 1, 7, and 8). In none of the patients have there been symptoms which could be attributed to bad results from operation. Of the 3 whom I was able to examine with the X-ray, there was a manifest backward flow in one (Case 7), some in another (Case 6), and nothing in the third (Case 1).

How can we explain this backward flow? Why does it occur in some cases and not in another, and why does it not produce disagreeable symptoms?

Normal peristalsis has been studied by numerous roentgenologists and they have confirmed our observations, that there are always in the ascending colon antiperistaltic waves which bring its contents back to the cæcum several times. In most of the cases the ileocæcal valve is an obstacle which allows the passage of new portions from the ileum, but not back from the cæcum into the small intestine. When the quantity of contents of the ascending colon has reached a certain amount, a peristaltic wave divides it and pushes some of it toward the anus. It is the function of the antiperistaltic waves to bring the contents of the cæcum and ascending colon into close contact with the mucous surface and to facilitate the absorption of the liquids contained.

Roith thinks that the antiperistaltic waves cease from the middle of the transverse colon downward, and that in this location an ileocolostomy with unilateral exclusion would not produce a backward flow. However, these antiperistaltic waves are no doubt the most important, but not the only, cause of the backward flow. In fact a backward flow has been demonstrated even in cases of ileosigmoidostomy, filling up the colon down to the cæcum. And as here no antiperistaltic movement has been noticed, we must suppose the flow is due to mechanical causes alone, although it is difficult to understand them. Stierlin has published a case from DeQuervain's clinic in which backward flow produced so serious symptoms that it was necessary to resect the cæcum and ascending colon. DeQuervain says that he has not seen the phenomenon in cases of tuberculosis for cancer, and explains it by the intolerance of the ulcerated bowel to its contents; there exists a hypermotility which empties the contents very quickly (Stierlin). He thinks that the reflux may appear again when the disease has healed and he has tried stricturing the ascending colon to avoid it. Case 1, in our series, does not confirm this opinion as there is no reflux after 7 years of clinical cure. Case 8 has a slight reflux down the ascending colon, and in Case 7 this reflux goes through the ileocæcal valve into the excluded coil of the ileum. But even in this case there are no clinical symptoms of backward flow, and after some time the intestine empties completely, so that I think we must consider this reflux as a physiological antiperistalsis which has no bad results and contributes, on

the contrary, to better extraction of the intestinal contents.

Basing my opinions on these considerations, I think that we should give unilateral exclusion a fair trial in properly selected abdominal cases. The advantage it has over simple entero-anastomosis is shown by the following case:

Henry B., age 34, entered the hospital February 26, 1918. He had had dysentery for years and suffered lately from intense abdominal pains which made him unfit for any work. The X-ray showed a nearly filiform stricture of about 10 centimeters long in the middle of the descending colon. I operated upon him February 27. The strictured part of the bowel was transformed into a hard cord. I made a simple transversosigmoidostomy with the idea of doing a secondary resection in case it should be necessary. Recovery was uneventful and patient left the hospital March 15. He gained rapidly in weight but the pain did not disappear. We could see with the X-ray that the pains came always when the contents of the transverse colon passed into the descending colon and worked its way through the stricture; the pains did not occur if the contents went through the anastomosis. The curious thing was that the former way of passing was the more frequent, in spite of the intense and painful peristalsis required to push the contents along and in spite of the fact that the anastomosis was of good size. The patient suffered a great deal, but as his general condition was much better and as he knew the dangers of a radical operation, he decided to put off operation until September 10, 1919. At that time I resected the whole descending colon. The operation was difficult because of the inflammatory condition of the bowel. Microscopical examination showed beginning malignancy in the center of the chronic inflammatory tissue, but the patient is now (2 years after operation) in good health and feeling fine.

This case proves that simple entero-anastomosis does not eliminte the strain of intense peristalsis against the strictured part of the bowel. If my first operation had been unilateral exclusion I would have saved the patient a great deal of suffering and would have had much less difficulty in the second operation, because the inflammatory symptoms would doubtless have subsided.

In comparing the advantages of bilateral and unilateral exclusion, there is a distinct advantage in favor of the unilateral method. The patient does not have to suffer the great inconvenience of an external fistula, which produces always a relative invalidity, and often is unable to do any kind of work. Compare this with my patient, Case 1, who has been able to continue his strenuous work as waiter in a hotel during the years since his operations; the same holds true also for Cases 2, 4, 5, and 7.

CONCLUSIONS

From my study of the subject I have drawn the following conclusions:

1. Unilateral exclusion of the intestine offers as great advantages as simple entero-anastomosis and as bilateral exclusion.

2. It is indicated chiefly—

a. In ileocæcal tuberculosis if the extension of the disease or general condition of the patient makes resection impossible.

b. In cancer of the colon if the extension of the disease or the general condition of the patient makes resection impossible.

c. In tumors the diagnosis of which is doubtful (inflammatory or malignant) and which produce stricture of the bowel.

3. Unilateral exclusion is superior to simple anastomosis in that it eliminates any strain on the strictured area and to bilateral exclusion in that it avoids an external fistula.

TUBERCULOSIS OF THE GENITALIA

With Review of Literature[1]

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TUBERCULOSIS OF THE VULVA

MODERN literature is very deficient with regard to cases of tuberculosis of the vulva. White (1) states that 25 per cent occurs in children and that when present in the adult, the age of incidence is between 30 and 40. It is unnecessary to dwell on the types found: two cases have occurred in our practice and both conformed to the hypertrophic variety. Tuberculosis of the type of pseudo elephantiases has not been encountered but it is easy to visualize this as an ending to a conglomeration of tuberculous warts. Bartholin's gland is seldom affected: Lecene (2) has published two cases. The symptoms and signs depend on the variety. Usually the patient complains of a swelling in the part with discharge when ulceration is present. Occasionally, as in a case of ours (a woman aged 36), the swelling assumes a type of pseudo-œdema, i.e., the appearance is that of œdema but there is no pitting on pressure and there are no causes for the apparent œdema. Dr. Pollock supplied the following reports on the above case:

(1) The tissue is mainly dense, fibrous tissue. There are numerous spaces under the epithelium filled with a serous fluid and a similar fluid lies in vascular spaces deeper down. There are collections of small, round cells, some close to the epithelium, some deeper down. The horny layer of the epithelium is distinct and in some places separated from the underlying layers. The down-growths of epithelium forming the papillæ are hypertrophied. (2) The condition appears to be a simple papilloma. Tubercles are present. Most of the enlarged mass is hard, fibrous tissue with small, round-cell proliferation in patches but the condition is undoubtedly tuberculosis.

The treatment of localized growths by excision of the vulva is eminently satisfactory. It is impossible in some to do other than palliative painting with strong antiseptics. X-rays have been used with good effect.

TUBERCULOSIS OF THE VAGINA

For the same reason that the vagina is resistent to inflammation because of its squamous epithelium and absence of glands, so it is rarely attacked by tuberculosis. It is seldom seen as a primary lesion and usually spreads from an infected perineal tear or from a fistula. The diagnosis of this rarity is from such other rarities as cancer and syphilis, and this can often be accomplished only by the microscope. When the growth is localized it must be removed, but as this is impossible in most instances, X-rays, radium, and antiseptic douches may be used to relieve if they do not cure.

TUBERCULOSIS OF THE UTERUS

In considering tuberculosis of the uterus, one must dwell on an ethical side, namely the mode of infection, and in a search of modern literature one meets with varied opinions. It is not intended to delve deeply into the question of infection of male by female but it is just as likely that advice may be sought by couples about to marry as to the likelihood of infection of the female by a potentially tuberculous male as that advice may be sought by a male who may be potentially gonorrhœal.

Bauereisen (3) writing on this subject quotes the case of a widow of a phthisical man who developed a tuberculous endometritis. The uterus was removed and death followed from sepsis: a postmortem examination showed no other lesion. This case seems to be not only one of cohabitation tuberculosis but also one of primary genital tuberculosis—an extreme rarity. Infection must arise either by transmission of bacilli from some other focus or by the direct deposit of bacilli in the vagina. Following experiments in which emulsions of virulent bovine bacilli were injected into the seminal vesicles of four male guinea pigs, the conclusion was reached that

[1] Presidential address to Obstetrical and Gynæcological Section, Royal Academy of Medicine in Ireland.

spontaneous ascent of the organisms in a normal vagina is impossible but that virulent bacilli may produce tuberculosis of the vagina from which further spread may take place. It is also suggested that movements of the uterus in orgasm and that the spermatozoa themselves may spread the bacilli.

Bauereisen disagrees with Max Muller (4) who states that primary tuberculosis of the genitals is never seen—Muller states that tuberculosis is a descending infection from the tube but this statement is obviously open to criticism in view of cases of vulvar tuberculosis which have been reported with absence of intra-abdominal trouble.

Geipel in an important research on sucklings proved that the tubercle bacillus passes via the respiratory and digestive tracts to the neck, thence by the bronchial, mediastinal, or mesenteric glands to the blood stream and sets up tuberculosis of distant organs. Muller as stated already is very definitely against primary infection and states dogmatically that proof of a local lesion constitutes a proof that this lesion is secondary, for the entry point of the tubercle bacilli usually escapes unscathed; although many will disagree he is of opinion that if the vagina be infected the next site is the regional lymph nodes, then the entire body with retrograde infection of an eroded or lacerated cervix as a point of lowered resistance. Max Kroner (5) says that either uterus or tube is infected independently by the blood or lymph or the endometrium is infected by spread from the tubes. In the latter cases the infection may travel from tube to blood stream and then to the uterus, or the endometrium is affected by tuberculous secretion from the tubes. Immunity is a powerful factor in genital tuberculosis, for it has been proved that when sperm containing tubercle bacilli are inoculated into the vagina, safety depends on the immunity acquired in childhood; when immunity is absent the disease is fulminating and progressive. Many writers have reported cohabitation tuberculosis.

TUBERCULOSIS OF THE CERVIX

Tuberculosis of the cervix is extremely rare and when present is difficult to diagnose both clinically and microscopically from malignant disease. The classification of ulcerative and proliferating, which is usually given, helps in no way to distinguish them and the symptoms are akin. In a case reported by Rudeloff (6), when a piece of cervix was removed and found to be malignant, on further examination after Wertheim's hysterectomy had been performed, tuberculosis of the cervix was diagnosed. The chief fallacy lies in confusing cell nests with epithelioid cells, and while general opinion is unanimous in agreeing that skilled pathologists may find it impossible to make a diagnosis, this can be done if the greatest care is taken in making a differential diagnosis between cell nests and epithelioid cells. The glassy appearance of the protoplasm is another important diagnostic point. Authorities agree also that cases of tuberculous disease of the tubes are often associated with a simple erosion which may contain apparent cell nests from which an incorrect diagnosis of carcinoma may be made.

Enough has been said to justify the warning to the microscopist to cut many sections in case of the slightest doubt in differential diagnosis between erosion, tuberculosis, and cancer. The treatment resolves itself into high amputation of the cervix, X-rays and Wertheim's hysterectomy. If the disease is localized, high amputation should be done with curettage of the corpus uteri. If bimanual examination reveals any intra-abdominal trouble, Wertheim's hysterectomy is the choice. If there is extragenital involvement, the local condition should be treated by caustics or X-rays.

TUBERCULOSIS OF THE BODY OF THE UTERUS

Corporeal tuberculosis in the form of endometritis is indistinguishable clinically from other forms of endometritis and the microscopic appearance may not help in the diagnosis.

Kundrat (8) states that despite this difficulty, if the whole picture be taken, a diagnosis may be made. In his series of 61 cases, the bacillus was found only 30 times, an experience encountered in our practice. Sometimes the cornua are attacked as part of a tubal infection.

Occasionally as in a case reported by us (7) the uterus assumes the appearance of a fibroid uterus and is often mistaken for it. The treatment of tuberculous disease of the body resolves itself into that for cases in which (1) endometritis only is present, when curetting usually cures; (2) the myometrium is involved and the body is enlarged, when treatment depends on the amount of tubal involvement and other factors which will be dealt with when considering this part of the subject.

TUBERCULOSIS OF THE TUBES

Tuberculosis of the tubes is the most common type of tuberculosis of the genitalia and may be looked upon as one of the common ailments of women, and therefore one which deserves more attention on certain points which will be shortly referred to. Its frequent occurrence is probably due to the many folds of the tube and the small circumference of the uterine ostium. The probable modes of infection have already been dealt with. With regard to frequency of tuberculosis in a series of 390 salpingectomies total or partial which we performed for tubal disease, there were 54 cases, or nearly 14 per cent. The varieties met with are differently described in various textbooks. Generally speaking they may be divided into cases in which (1) the tubes are slightly enlarged and when the abdomen is opened the definite diagnosis of tuberculosis is impossible; (2) the tubes are much enlarged and no tubercles are present; (3) the tubes in which tubercles are present and the diagnosis is obvious; (4) the tubes and abdomen are involved in generalized tuberculosis. The importance of this classification will be made evident when dealing with treatment. The symptoms of tuberculous salpingitis give no clue to the disease. Sometimes there is a family history of tuberculosis. Sterility and leucorrhœa are the most common complaints we have met with. Menstruation lasting for 2 days, ceasing for a day and then continuing for 2 or 3 more days leads one to suspect tubal disease when nothing can be felt macroscopically. Pestalloza (9) and others find amenorrhœa as a symptom but we have found that this is present only in cases of large pyosalpinx involving the ovary or where the patient is generally phthisical. Dysmenorrhœa, menorrhagia, and metrorrhagia are occasionally seen.

Pains in the side and back are present when a tuberculous prosalpinx assumes much size or when abscess forms, and rise of temperature and pulse are found when the condition is acute or in the presence of exacerbation of a chronic case. As has been stated already the diagnosis by symptoms is very often impossible and even when the abdomen is opened and later at the microscope, tuberculous salpingitis may still be a matter for question. The signs depend on the variety and there may be felt varying degrees of enlargement from a slight thickening of the tube to enormous pus sacs. Sometimes the diagnosis presents the greatest difficulties. A case lately came under our observation which I will report.

A woman, age 64, gave a history of no note except that she had remarked a tumor in the left side of the abdomen for some months. On bimanual examination the uterus was palpable in front with a tumor adherent to the left broad ligament. This tumor was apparently the size of two clinched fists, and a diagnosis of malignant degeneration of a myoma or cancer of the colon was made. An X-ray diagnosis made by Dr. Hardmann after a barium meal was as follows:

"Obstruction in transverse colon but one cannot say whether due to a primary growth of the bowel or due to adhesions between the colon and the palpable tumor which may be colonic." As the definite diagnosis had not been made by clinical methods and X-rays it was decided to give a barium meal by the rectum, after which the report read: "The opaque enema flowed back as far as the hepatic flexure, when it ceased to advance, confirming the former diagnosis of obstruction in that region." At laparotomy difficulty was experienced in opening the abdomen because of adhesions. After many of these were broken down a condition of double pus tubes was demonstrable. These were enucleated and all bleeding points stopped and a cigarette drain inserted in the pelvis because of oozing. The tumor on the left was distended intestine adherent to the pus tube. The adhesions on all sides confirmed the X-ray findings.

This case is reported to show the extreme difficulties which may exist with regard to diagnosis. We have dealt with and sent a questionnaire to only 54 of our cases, as we considered that number would be sufficient for our present purpose, but the number of cases of sterility which we have encountered

in which the patients had been curetted many times for cure (?) of sterility and leucorrhœa and in which tuberculosis was present makes us reiterate our counsel that the abdomen should be opened in all doubtful cases of sterility and we say this despite recent work by Rubin (10) Rongy (11) and others on insufflation of the tubes with carbon dioxide. We have one case in our series where the unfortunate woman had been curetted four times by three different men when she was suffering from two large tuberculous pus tubes. Such cases as these should be easy to diagnose. The main purpose in the questionnaire was to ascertain if possible the correct treatment for tuberculous salpingitis, and we believe that we have found the correct treatment. Every patient for whom we did double salpingectomy was in perfect health in every way since the operation. Every patient in the series who had a partial salpingectomy with a view to cure of sterility, had various after-complaints and two contracted abdominal tuberculosis while none became pregnant. In any case where hysterectomy was done in addition the patient had good health, but this operation is unnecessary except where the uterus is involved in tuberculous pyometra, but it is often necessary to remove portions of the cornua at the uterine insertions of the tubes. To bear out the futility of performing hysterectomy in addition to salpingectomy we have examined curettings which have been found to be tuberculous before operation. Three months after salpingectomy curettings examined again were found to be free from disease. In other words our early hopes of palliative measures on the tubes for tuberculous salpingitis have not been borne out by the subsequent history. There is no doubt that isolated cures of sterility are accomplished by resecting tuberculous tubes, but these are so isolated and the results are so much better from complete salpingectomy that the latter is the operation of choice. We do not mean to convey that plastic work should not be done for other forms of tubal disease. This is a very different matter and the good results obtained thereby justify the operation. In other words the ideal treatment of tuberculous disease of the tubes is to remove them—not to resect them. In cases where it is impossible to diagnose take the risk and resect them. If later the microscope reveals tuberculosis and the patient suffers, a second operation may be done. When the abdomen on being opened is found to be involved generally in disease, the mere opening and closing is found to have good results, in some cases; in others, they go down hill rapidly. In some cases, however, where the disease appears to be generalized in the abdomen, it is possible to enucleate pus sacs which are present on both sides. If this can be effected, the prognosis is more favorable. Stevenson (12) has reported good results with radium, and Crofton (13) with vaccines. Vogt (14), in a communication on the combination of operative and X-ray therapy, finds that the radical operation gives the best results when possible but that prophylactic radiation, i.e., radiation after operation (either when it has been possible to remove disease or not) improves the after-results, i.e., operation followed by X-rays is the best treatment. When operation is contra-indicated for any reason X-rays alone should be used. We have found that operation without X-rays in most cases is sufficient but some patients are benefited by a course of postoperative X-rays. In the same way postoperative vaccine treatment is a great help to many, but we deprecate strongly the treatment of tuberculous salpingitis by vaccines, where the abdomen has not been opened to make the diagnosis definite.

We have not dealt with tuberculosis of the ovaries. As a separate entity it is rare; when present it is nearly always bound up with the diseased tube and should be removed with it.

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MALIGNANT NEOPLASIA OF THE KIDNEY OCCURRING IN INFANCY

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MALIGNANT tumors of the kidney, occurring in infancy, have been widely studied both by means of individual and collected cases. Various views have been advanced with regard to the microscopic interpretation and the pathogenesis. The hypothetic doctrines of cell rests and embryonic inclusions and the theory of metaplasia have been drawn on for explanations. Confusion, rather than clarity, has been the result. In early studies of the condition, tumors were designated by the broad term, "cancer." Eberth, finding muscle fibers in a "fibrosarcomatous" growth, commented on the mixed character of the tumor. Jacobi believed that most of the renal growths occurring in children were sarcomatous. Birch-Hirschfeld drew attention to the epithelial tubules embedded in sarcomatous tissue. Such neoplasms have been designated in the literature, as embryonic carcinomata, adenosarcomata, adenomyosarcomata, adenochondrosarcomata, myosarcomata, teratomata, and adenocarcinomata. A diffuse cellular growth with epithelial tubules, fibrous tissue, striated and unstriated muscle, cartilage and bone are said to occur in these tumors.

Such tumors are now usually designated as the mixed embryonic tumors of Wilm; they are also referred to as adenosarcomata (Ziegler), composite tumors (MacCallum), and adenomyosarcomata (Ewing). Ewing also recognizes an embryonal adenocarcinoma, occurring in children. Garceau asserts that these tumors show certain structures which have been called carcinomatous, but the presence of sarcomatous elements, as well as the character of the tumor precludes the possibility of classifying them with carcinomata.

Bland-Sutton says: "The renal sarcomata of infancy arise in the connective tissue of the renal sinus. The epithelial cylinders are due to the entanglement of uriniferous tubules, in consequence of the sarcoma invading the cortex, while the striated spindles are derived from the muscle tissue of the renal pelvis. . . . These studies demonstrate in no uncertain way that renal sarcomata in infants are extrinsic in origin and strictly non-renal."

Three views with regard to pathogenesis have been maintained: that the tumors are derived, (1) from the Wolffian body, (2) from the embryonic kidney, or (3) from aberrant cells of the myotome or other similar structures (Wilms). The latter theory has been accepted as the most probable.

The material of this study consists of seven renal neoplasms from seven children (six females and one male); the eldest was 7 years, and the youngest 20 months of age. The growth was situated on the right side in five cases, and on the left in two. The largest tumor weighed 760 grams.

REPORT OF CASES

Case 1. (A360819.) E. F. M., a girl, age 4 years, was operated on for removal of the right kidney; a neoplasm measuring 13 by 10 by 18 centimeters, and weighing 525 grams was revealed. The mass was nodular and consisted of a distorted kidney in the substance of which was a solid, irregular mass. Upon gross section, hæmorrhagic cystic degenerating areas were found. The color and general appearance of the cortex of the distorted kidney were normal, although it was thinned by dilatation of the calyces and pressure of the neoplasm. The mass was intimately associated, grossly, with the renal tissue; it was definitely invasive (Fig. 1). Low power microscopic examination showed two apparently distinct types of tissue (Fig. 2). These were diffuse (Fig. 3) and glandular (Fig. 4). When examined with the oil immersion lens, the cells comprising these two types were morphologically identical, the only difference being the degree of differentiation of those of the glandular type. Efforts to determine whether or not these cells have a common origin have been futile; the two types are often fused. The presence of these apparently different types of tissue (with the low power of the microscope) has been responsible, doubtless, for the term, "mixed tumors."

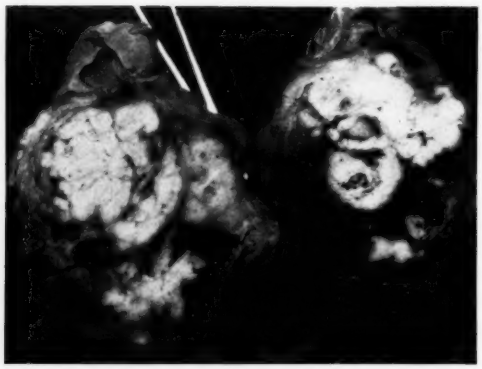

Fig. 1. Gross specimen from Case 1.

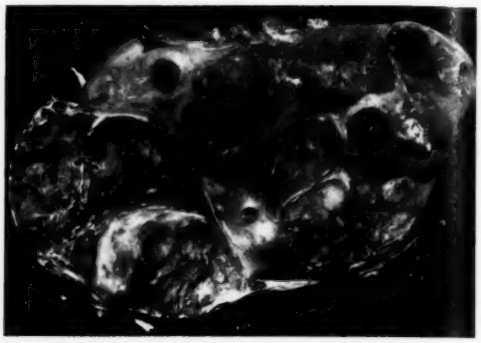

Fig. 5. Gross specimen from Case 2.

CASE 2. (A358573) D. G., a girl, age 7 years, was operated on at the Clinic; the right kidney, removed at operation, weighed 760 grams. The mass was nodular and consisted of a distorted kidney in the substance of which was a solid degenerating hæmorrhagic neoplasm. This neoplasm, by pressure and invasion, had almost completely destroyed the renal cortex and obliterated the renal pelvis. The distorted renal cortex was infiltrated and almost completely replaced by scar tissue (Fig. 5). This neoplasm also was apparently composed of two types of tissue, one, diffuse (Fig. 6), and the other, glandular (Fig. 7). The tissues were fused; the cells themselves were morphologically indistinguishable under the oil immersion lens. The differentiation into glands is higher than in (Case 1).

CASE 3. (A73668.) S. C., a girl, age 5 years, was operated on at the Clinic. Right nephrectomy revealed a spheroid, somewhat nodular mass consisting of a distorted kidney and a solid infiltrating neoplasm. The renal cortex, pelvis, and calyces were practically obliterated, although small traces of the cortex identified the neoplasm as a renal tumor (Fig. 8). The neoplasm, as in (Cases 1 and 2), was composed essentially of two types of tissue, one, diffuse (Fig. 9), and the other, somewhat glandular (Fig. 10). The cells under the oil lens were indistinguishable, the only apparent difference being a low degree of differentiation into glandular arrangement.

CASE 4. (A244983.) S. K., a boy, age 4 years, was operated on at the Clinic; an enlarged left kidney, weighing 440 grams, was removed, and was found on gross section to contain a hæmorrhagic, degenerating, solid, infiltrating neoplasm which had partially distorted the renal cortex and almost completely obliterated the renal pelvis and calyces (Fig. 11). This neoplasm presented two types of tissue on low power examination, one, diffuse (Fig. 12), and the other, glandular (Fig. 12 and 13). On examination with the oil immersion lens the cells were found to be indistinguishable, morphologically, the only difference being the partial differentiation into glandular structure (Fig. 13).

CASE 5. (A283231.) L. L., a girl, age 20 months, was operated on at the Clinic; the right kidney, weighing 670 grams, was removed. Photographs were not made of the gross specimens, but micros-

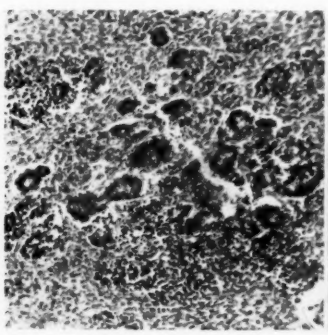

Fig. 2. Photomicrograph of specimen from Case 1. (×100.)

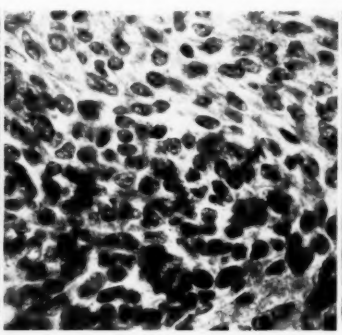

Fig. 3. Photomicrograph of specimen from Case 1. (×500.)

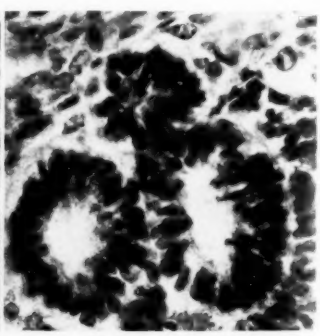

Fig. 4. Photomicrograph of specimen from Case 1. (×500.)

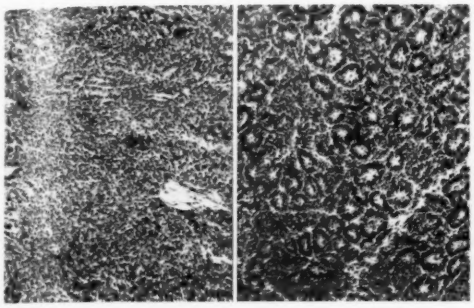

Fig. 6 (at left). Photomicrograph of specimen from Case 2. (×70.)
Fig. 7. Photomicrograph of specimen from Case 2. (×70.)

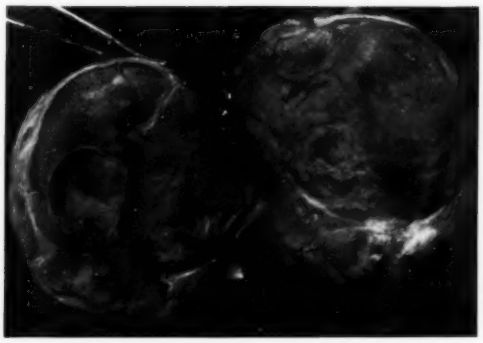

Fig. 8. Gross specimen from Case 3.

copic sections revealed a diffuse (Fig. 14) and glandular (Fig. 15) growth. In this specimen, as in the others, the cells were occasionally partially differentiated in gland-like structures.

CASE 6. (A253437.) E. McK., a girl, age 3 years, was operated on at the Clinic. Removal of the right kidney revealed a mass 11 by 7 by 4 centimeters which, on gross section, was found to consist of a small portion of the renal cortex and ovoidal hæmorrhagic, degenerating, solid neoplasm which apparently had distorted, partially destroyed, and infiltrated the kidney. The calyces and pelvis were obliterated (Fig. 16). Microscopic examination revealed diffuse and glandular neoplastic tissues which were fused in portions of the sections (Fig. 17). Like the cells in Case 2 (A358573) the glandular differentiation was of a rather high degree and on low power study the glands appeared to be composed of columnar cells. Under oil immersion the cells themselves were not columnar; they were still undifferentiated and resembled those of the diffuse portions of the neoplasm.

CASE 7. (A123624.) E. T., a girl, age 4 years, was operated on at the Clinic. A solid nodular mass removed from the left side was composed of a distorted kidney and a solid, hæmorrhagic, infiltrating neoplasm. The renal cortex, although almost completely destroyed, was easily recognized in spite of the extrinsic replacement by scar tissue. The renal calyces and pelves were obliterated (Fig. 18). On microscopic section this neoplasm, like the others, was found to be composed of diffuse neoplastic tissue (Fig. 19) and glandular tissue (Figs. 20 and 21). The cells of both apparent types of tissue were indistinguishable under oil immersion lens (Fig. 21).

In the microscopic examination of these specimens it was found that they were composed of one type of cell in various stages of differentiation and with varying amounts of connective-tissue reaction. The appearance

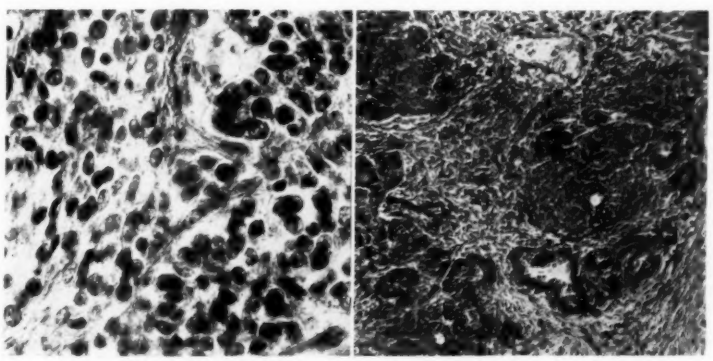

Fig. 9 (at left). Photomicrograph of specimen from Case 3. (×500.)
Fig. 10. Photomicrograph of specimen from Case 3. (×100.)

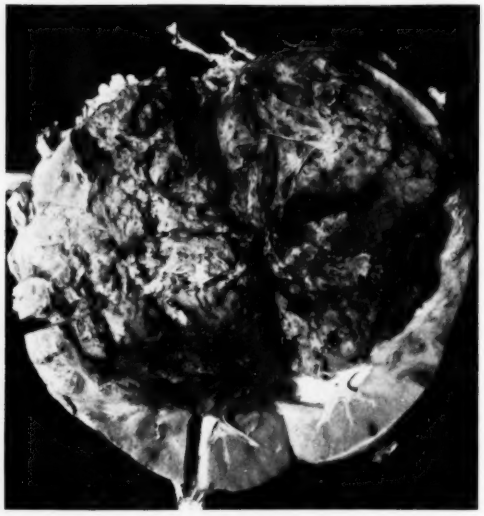

Fig. 11. Gross specimen from Case 4.

of the cells under the oil immersion lens and their tendency to form into gland-like structures leads us to classify the neoplasm as carcinoma of the adenomatous type. There does not appear to be any resemblance between these glandular structures and the normal renal tubules.

Since the low power pictures of these specimens vary, and the cytological studies reveal that the variation is the result of degrees of differentiation, it would seem that a classification based on cytological differentiation might be utilized instead of a classification largely based on low power resemblance to normal tissues. Neoplastic cells which bear no cytological resemblance to any adult tissues are often arranged in glandular form and still are not adult cells. The malignancy depends, in large part, on the degree of differentiation. Thus a neoplasm wholly composed of gland-like structures, formed by neoplastic cells, is in all probability less malignant than one composed of the same type of cells diffusely arranged.

It might be suspected that there are varying degrees of malignancy, since there is great variation in degree of differentiation in the neoplasms. They have both undifferentiated and partially differentiated tissues of the same apparent type of cell and wherever undifferentiated neoplastic cells exist a bad prognosis may be expected.

Three of the seven children died within a year after operation; two are alive, but not well, 1 year after operation. One is perfectly well 18 months after operation, and one cannot be traced.

Since these neoplasms are composed of cells which resemble adult tissues in arrangement, but morphologically are unlike any normal adult tissue cells, we prefer to classify them as pseudotextomata.

Group 1. Textoblastomata or blastomata embrace all neoplasms which are composed

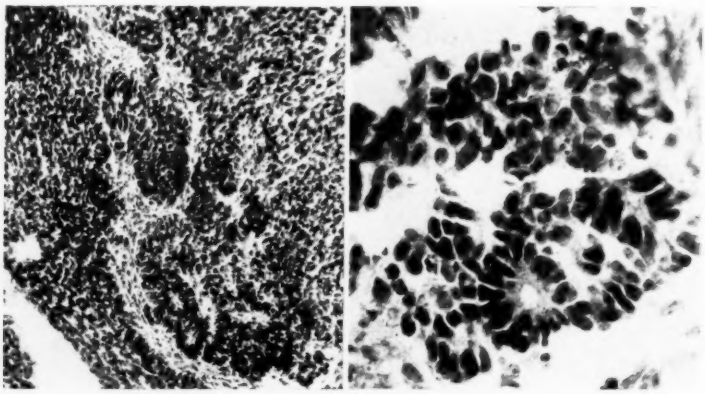

Fig. 12 (at left). Photomicrograph of specimen from Case 4. (×100.)
Fig. 13. Photomicrograph of specimen from Case 4. (×500.)

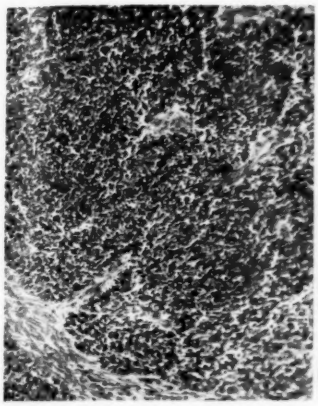

Fig. 14. Photomicrograph of specimen from Case 5. (×70.)

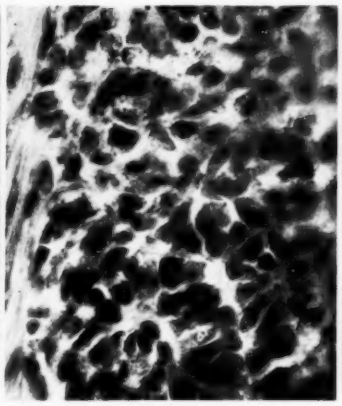

Fig. 15. Photomicrograph of specimen from Case 5. (×500.)

Fig. 17. Photomicrograph of specimen from Case 6. (×70.)

of cells so undifferentiated that it is impossible positively to recognize the textocytes into which they would develop if differentiation occurred. They are neoplasms, the principal cells of which do not resemble any adult textocytes in the organism. Such neoplasms occur in practically all parts of the human body; they are usually, if not always, soft, vascular, cellular tumors possessing the power of rapid growth, invasion of neighboring tissues, and of metastasis. They have been called sarcomata, but all the neoplasms in the literature which have been called sarcomata do not belong to this group, since many consist of cells which are partially differentiated and hence belong to Group 2, the pseudotextomata.

Group 2. Pseudotextomata embrace all neoplasms which are composed of partially differentiated cells and hence resemble, in arrangement, certain normal adult tissue cells of the organism. Such cells, however, do not have the exact morphology of adult textocytes, although they may be arranged similarly to the normal arrangement of adult tissue. Thus the partially differentiated cells may be arranged in planes, like the cells lining the alimentary tract, blood vessels, ducts or the epidermis of the skin; they may line a sphere or a portion of a sphere such as the acini of the glands. The cells may be arranged with or without having their long axes parallel or forming the radii of a sphere.

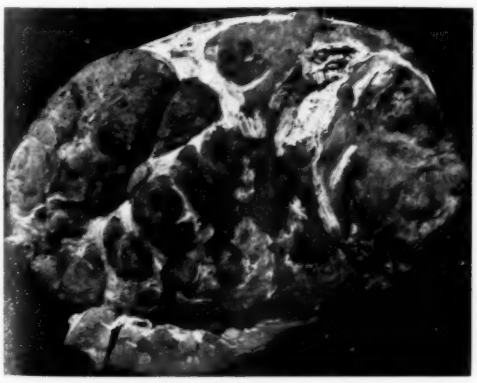

Fig. 16. Gross specimen from Case 6

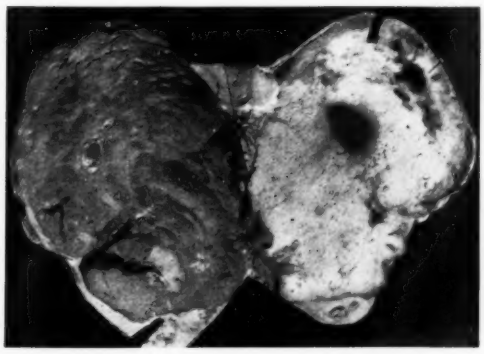

Fig. 18. Gross specimen from Case 7.

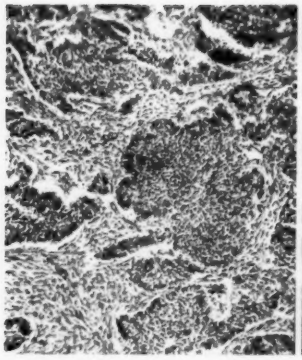

Fig. 19. Photomicrograph of specimen from Case 7. (×70.)

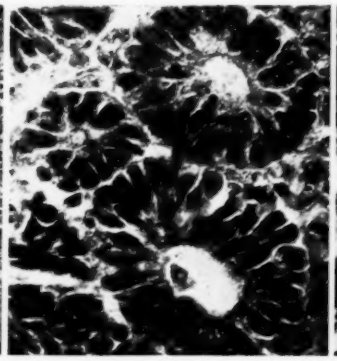

Fig. 20. Photomicrograph of specimen from Case 7. (×500.)

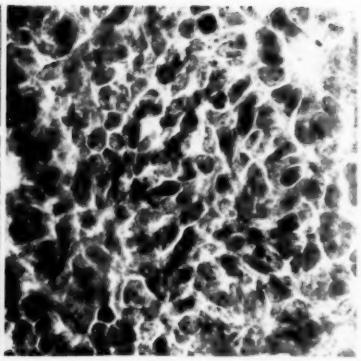

Fig. 21. Photomicrograph of specimen from Case 7. (×500.)

Group 3. Textomata embrace all neoplasms which are composed of cells sufficiently differentiated to be morphologically identical with, or indistinguishable from, normal adult tissue cells (textocytes). In the production of such neoplasms the differentiation is apparently complete; but the rate of differentiation remains parallel to the increased rate of hyperplasia, hence the neoplasm continues to grow; but as the result of the close proximity of the two rates, the growth is slower than that of pseudotextomata and textoblastomata, in which the rate of differentiation is slow, or there is no differentiation.

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LONGITUDINAL OVERGROWTH OF LONG BONES[1]

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LIVING long bones grow in two general directions. They must increase in the transverse diameter to respond to the call of weight bearing and the augmenting activities of life; they must increase in length to bring the individual to his mature stature. With the first mentioned growth we are not interested at this time; it is a regular, steady thickening of the bone shafts and ends, compensatory in character, and so uniform is the process that little attention is paid to it. If we agree with Macewen, we may believe that the periosteum limits this growth while holding the bone in the shape desired for its particular purpose, and also preventing bone cells from wandering out into adjacent tissue to cause disturbances which would interfere with normal physiological action.

Disturbances of growth of long bones in their longitudinal axes are fairly common, and as they lead to skeletal changes involving the whole body and result in disability and disfigurements, they assume surgical importance. A year ago I reported a series of instances of longitudinal growth interference following osteomyelitis among adolescents,[2] principally in the nature of stoppage of growth. Some of the experimental and physiological findings in that connection were reviewed and operative remedy for these deformities was suggested. When one bone in the forearm or leg ceased growth following inflammation of its epiphysis or diaphysis, embarrassing deformities with deflections of hand or foot resulted.

At this time we are interested in the opposite side of the problem, namely where the lesion influencing the normal growth is of such a character that instead of being destructive and damaging to the epiphyseal cartilage plate so that growth ceases, a stimulation seems to take place resulting in too much growth. This excess growth as directed toward the long axis of the bone is shown by an overgrowth or visible lengthening of the limb involved. This lengthening may take place without simultaneous increase in the transverse diameter of the bone, without increase in the size of the limb except its length and, as a rule, tends to lengthen only that portion of the limb involved in the process, leaving the remainder and the body as a whole uninfluenced as to normal size.

We understand that certain common factors frequently influence the growth of adolescent bones. The various diseases of bones, as rickets or osteomalacia, chronic or even acute illness, untoward action of the various glands of internal secretion, and even influence of the nervous system, may affect size and length of long bones. This is usually, however, a symmetrical process. A unilateral enlargement of the whole body may occur, involving the bones of the head, chest, pelvis, arm, and leg. This is really unilateral macrosomia (hemihypertrophia totalis or crossed inequality), unrecognized cases of which have been reported.[3] Black-Milne[4] reported one instance of macrosomia and also one instance of congenital overgrowth of the right leg, examples of which I have seen and which we call localized giant growth. In one child the whole side of the body was larger than the opposite or normal side, the leg being not only heavier and thicker but also longer. The second patient described in Black-Milne's report was unique. The only part of the body involved was the right leg which was ¾ inch longer than the left leg, but its musculature was not so well developed. The spine and pelvis had bent to allow for this overgrowth. The strange point was that the father of this family in which there were four sons including the one described, had the same anomaly in about the same degree. This case does not appear to be localized giant growth, but may fall into the class of those I am about to report. Other references are also of interest.[5]

The instances of long bone overgrowth I wish to record are different. They are closely connected with and subsequent to inflam-

[2] Speed. Surg., Gynec. and Obst., 1922, April.

[3] Noronha. Indian M. Gaz., 1921, lvi, 10.

[4] Brit. J. Child. Dis., 1920, xvii, 79.

[5] Coston. Med. Record, 1920; xcvii, 222; Gordinier. Albany M. Ann., 1918, xxxix, 47.

[1] Read Before the Chicago Surgical Society, January 5, 1923. (For discussion see p. 847.)

mation of varying degree, one instance seemingly starting from a trauma without resulting in an inflammation that formed pus. Their like must occur elsewhere although the literature on this topic is scant.

Reed[1] in his work on the growth of trees concludes that the rate of growth of organisms may be considered as a chemical reaction which gives the mature organism as its end product. Moreover, the given organism grows at a definite rate which is, at any moment, proportional to the amount of growth yet to be made. These instances of overgrowth then must occur in adolescents who still have a certain amount of normal growth coming to them, but some stimulation as from the action of toxins of an inflammatory process in or near the growing part of the bone which leads to length overcomes the natural limit and growth goes on beyond any intended normal extent. This is not a delay in ossification nor a prolongation of the cartilaginous life of the epiphysis but is really an overgrowth as far as these cases show, because the growth occurred when the patient was 4 or 5 years of age. It is apparently not comparable to the wild growth infiltration of malignant tumor cells which go on to destroy the whole organism. While the length growth of the bone seems wild and uncontrolled, it is not deadly and must soon reach its limit.

We understand that length growth of long bones takes place in the cartilage plate and the juxta-epiphyseal region of the diaphysis, ossification continuing to extend behind the cartilage plate which goes on growing. The epiphysis of a long bone ossifies first at the end of the bone where the greatest increase in length takes place, namely that end toward which the nutrient artery is directed. Ollier has attempted to prove that exhausted nutrition in the bone indicates which epiphysis will unite first. When the growth has nearly ceased, there the epiphysis unites so that the epiphysis which unites last with the shaft is the one with the most active proliferation. But this difference in the two ends of the shaft of the bone is manifested from the time of birth, before any epiphysis has appeared or joined on. We may then consider that the unequal growth of the two ends of a long bone is caused by the unequal value of the epiphyseal cartilages, being indicated from birth independent of the union of the epiphyses. A bone shaft in an adolescent may be completely resected for osteomyelitis but if it regenerates it may equal or exceed its fellow bone in length. I have had such an experience after shaft resection where the juxta-epiphyseal area was left behind. Davis[2] reported an instance of transplantation of an epiphysis into a defect in the fibula, the newly implanted bone uniting and giving a final satisfactory length by growth. In this instance the implanted growing bone took up the function of its new environment and conformed to the requirements exacted of it.

Poland quotes Bruns as finding in 100 cases of traumatic epiphyseal separation, 13 instances of arrest of growth. The reason we do not find a greater number of growth arrests is probably because traumatic epiphyseal separations are quite uncommon in the first decade of life. Also, in most instances, the plane of separation is probably one which passes through the layer of partly formed bone just next to the cartilage and not through the cartilage itself. Consequently the osteogenetic layer of the bone remains uninjured and its growth function continues normally. If the cartilage is injured and the patient is 15 to 18 years of age, the growth interference is not liable to be so extensive.

Bone lengthening is rarer than bone shortening. After fracture 6 cases of lengthening of the femur have been mentioned by Bruns. This may explain the fact that fractures of the femur in children, which heal with overriding, in later life show no shortening. I have seen at least 20 instances of this compensating growth. Ollier says this lengthening cannot exceed $^1/_{15}$ or $^1/_{20}$ of the total length of the bone, so we must not count too much on it.

An irritation of the required character applied to the medullary cavity of a bone or to the periosteum at a distance from the epiphyseal cartilage may induce overgrowth and hypertrophy with lengthening of the bone. As far as we know, this irritation must be indirect; if the cartilage cells are directly irri-

[1] J. Gen. Physiol., ii, 545.

[2] Ann. Surg., lxiv, 519.

Fig. 1 (at left). Case 1. The increase in leg length with difference in muscle bulk, especially from knee to foot is seen. The tilting of his pelvis is shown by the marks on the anterosuperior iliac spines.

Fig. 2. Roentgenogram of both legs of Case 1, showing knee joints on same level, with increase of length in tibial shaft. The fusion between tibia and talus is apparent and the fibula seems to have kept up in relative growth with the tibia. Increase in length equals nearly 2.5 inches. The left tibia shows increase also in diameter with some bowing and with suggestion of cavities within the bone.

tated and stimulated we are more likely to find a death of cells and a stoppage of growth. This has been proven experimentally as mentioned in detail in my report a year ago. Ollier reports that a central osteitis of the tibia with a quiet necrosis of bone induced a lengthening of the bone of 6 or 7 centimeters.

If suppurative osteomyelitis or trauma near the juxta-epiphyseal area with or without some separation of bone leads to bone lengthening, we may assume that the cells in the cartilage plate were not directly inflamed or injured but that they were indirectly stimulated and an overgrowth resulted. Had the infection or trauma caused direct interference with these cells, stoppage of growth might be expected. However, in the instances here described, although the bone in some was thickened beyond normal, the amount of long overgrowth did not seem proportionate to the thickening. We found also that the epiphyses appeared quite normal and did not show gross changes nor delay in closing in the mature individual. The growth seems to lie clearly in the diaphysis, the osteoblasts becoming superactive, laying down too much bone. The following clinical cases seem to be examples of this rare type of overgrowth.

Case 1. A. B., male, age 45, a farmer. When 6 years of age a thorn penetrated his left leg just above the ankle. Inflammation and abscess followed, so that 10 days later, when the abscess was lanced, the thorn was evacuated 6 inches above its point of entrance. A sinus discharging pus developed which cast off a few small pieces of bone and persisted for 15 years. From the age of 22 to 38 years the sinus and pus discharge disappeared but from the latter age to

Fig. 3 (at left). Amputated leg bones specimen. The thickening of the tibia, its anterior bowing and fusion with the talus, is shown. The fibula appears to have kept pace in growth with the tibia.

Fig. 4. The tibia sawn open longitudinally. The great thickness of cortical bone laid down during the long course of the osteomyelitis, the fusion with the talus with all loss of ankle joint surface, the cavities of the old medulla and the fresh sequestrum in the head of the bone in the old epiphyseal area, are shown.

the time of admission to the hospital, nearly 7 years, pus had been discharging intermittently. During these years he has been able to continue his work. In his boyhood he formed a habit of standing on his good leg, seldom putting any more weight than he could help on the diseased leg. At one time during the acute condition during confinement to bed he had allowed the leg to lie for a long time on one side, so that it seemed later to bend outward a little. To overcome this a brace was worn to straighten the leg. His ankle became very painful and later quite stiff but there never developed any sinus near the ankle joint. He felt that his ankle and foot used frequently to get out of place in some manner after use, so that he had to sit down and attempt to push his foot back into position. Up to a short time ago, he weighed 200 pounds, but within 3 months he lost rapidly about 30 pounds in all. For the last 3 weeks he has had much pain in his left knee, this with an increase in discharge of pus really bringing him to the surgeon. No operation except the original stab lancing of the leg abscess has ever been performed on the leg. His past history discloses chicken pox, typhoid fever, and mumps in adolescence. For the past 12 years, up to 2 years ago, he has had asthma of an infective bronchial type. After he was married, age 24 years, he had measles. Two brothers are dead, one of pulmonary tuberculosis and anal fistula, the other of a rapidly wasting condition following influenza in 1918, probably pulmonary tuberculosis.

His physical examination reveals little of interest except the essential pathology in the left leg. A cardiovascular examination shows no palpitation or adventitious heart sounds or enlargement. Hands and feet are not swollen but there is slight shortness of breath on exertion. His genito-urinary history is negative. His blood showed 8,250 white blood cells, hæmoglobin 85 per cent; blood pressure 124 systolic, 88 diastolic; Wassermann negative. An X-ray examination of the chest shows the findings of a possible incipient tuberculosis of the left apex, not definite. On the day of hospital admission, November 20, 1922, 4 drops of urine reduced 5 cubic centimeters of Haines' solution, but was otherwise negative.

The main interest lay in his left leg, the right leg being normal in all respects. He walked with considerable lameness and thought that his left leg was shorter than the right. Left knee and hip motion were of normal extent but lately (3 weeks) the knee had become painful. The knee joint was not swollen. The left ankle was firmly ankylosed but there was considerable compensating motion in the mid-tarsal joints.

The left leg presented anterior bowing, especially in its lower half. The lower two-thirds of the tibia were thickened, and there was a small, recently closed fistula in the lower portion near a number of small old scars on the outer surface of the shin. About 8 centimeters from the lower border of the patella on the shin was a tender area, which extended upward toward the tibial tubercle.

Measurements of the lower extremities were as follows:

	Left leg	Right leg
Anterosuperior iliac spine to internal malleolus	30 inches	36.75 inches
Superior border of patella to internal malleolus	19 25 inches	17.50 inches

There was present then a lengthening of the whole leg equivalent to about 2.25 inches over the normal right leg. Most of this lengthening, as far as measurements showed, seemed to be in the tibia.

X-ray examination of both tibiæ showed no change in the right tibia, but the left showed great thickening with evident cavity and cloacæ formation in the shaft. The talus was apparently fused on to the lower end of the tibia, but did not interfere with the definite localization of the internal malleolus for measurements.

After a week's preparation on restricted diet, finding that the patient's temperature now remained

Fig. 5.

Fig. 6.

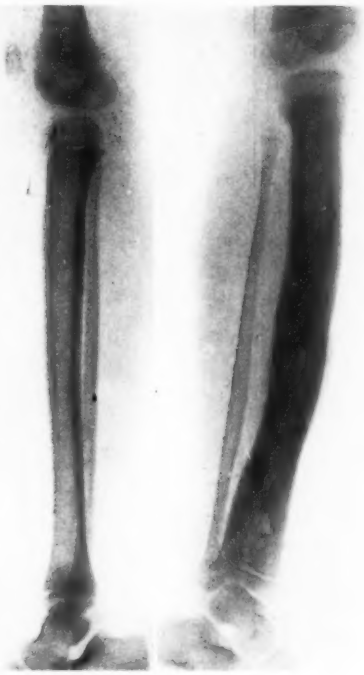

Fig. 7.

Fig. 5. The second patient showing the increase in leg length with pelvic tipping and tibial thickening. The overgrowth lies in the elongated tibia.

Fig. 6. Roentgenogram of both legs of Case 2. The knee joints are on the same level, and the increase of length of the infected leg is seen. The shaft of the infected tibia is typically thickened as in chronic osteomyelitis; cavities are apparent deep in the bone. The upper end of the fibula appears to have lagged behind slightly in growth. The epiphyses of the infected bone appear unchanged and compare favorably with the normal leg.

Fig. 7. Lateral views of the leg of the second patient with confirmation of the findings given in Figure 6.

about 102° each day and the amount of urinary sugar showed no intention of decreasing, a mid-thigh amputation under gas oxygen anæsthesia was performed. There was no shock, and within 4 days after amputation all evidence of sugar in the urine disappeared and never again returned during his hospital stay of 3 weeks. The stump was healed, with stitches removed, by the ninth day.

The amputated leg was dissected; no pus pockets were found in the soft parts. There was no septic thrombophlebitis and the knee joint was negative. The vessels showed a fair degree of sclerosis. The tibia and fibula were cleaned of soft parts and hardened. Later the tibia was sawn longitudinally. It shows the great sclerosis of the newly formed cortex typical of chronic osteomyelitis. In the head of the tibia about the area of the former epiphysis is an area of recently formed dead bone, with irregular margins extending in all directions but not yet broken down into pus. In the center of the bone leading from this area down into the old medullary cavity were winding passages and cavities containing pus, but with no complete cloacæ opening into the soft parts around the bone until the solitary opening in the lower third was reached. The intermittent character of the discharge of pus from this opening was probably induced by the varying pressure of the pus within the bone, and the recently formed dead bone in the head of the tibia—which had shown tenderness—was probably the result of this same retention of pus.

The lower articular surface of the tibia seemed completely fused with the talus, no joint surface being found on section; the lamellæ of cancellous bone of the tibia extending down into the talus.

Microscopic sections were made from bone taken from the old epiphyseal areas at each end of the tibia. No cartilage cells were found, the original epiphyseal area being completely obliterated and occupied by cancellous bone as one would expect to find in a man of this age. In the sequestrated area of the upper epiphysis, dead bone was found, not yet undergoing absorption.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 8. Case 3, showing length overgrowth of the right leg, with its smaller musculature. The increase in length appears to lie in the right femur as noted by the marked anterosuperior iliac spines.

Fig. 9. Pelvis and femora of the third patient. The right femur is found to be much longer than the left.

Fig. 10. The legs of the third patient. The right tibia seems a little longer than the left and the head of the right fibula is a greater distance from the plane of the knee joint than on the left side. Some of the joint changes on right side are seen, the narrowing and depression of internal tuberosity of tibia. The bone is not so sturdy as left leg bone.

CASE 2. S. J., female, colored, 5 years old. About a year ago she developed an acute osteomyelitis of her left shin bone, for which a delayed operation of drainage was performed. How extensive this operation was it is not possible to state. The bone continued to be painful and discharge pus, lately only intermittently through a sinus on the anterior surface of the lower third of the shin.

This child seemed in good general health on hospital admission and presented uniformly negative findings except for her left leg. The Wassermann test was negative. This left leg was longer than the right leg, but with little atrophy of the thigh and with knock knee and anterior bowing and a slight increase in size of the left shin which seemed to be entirely thickened, roughened bone. There were old scars over the middle of the anterior surface of the shin and one sinus discharging thin pus. Her temperature and pulse were normal. The range of motion of the left knee and ankle was normal and painless. X-ray examination showed a much thickened and denser tibia than normal. There were several areas of apparent cavity formation in the shaft of the bone. No gross roentgenographic changes were noticeable in the epiphyses of this tibia as compared with its fellow tibia except the general greater density of that bone everywhere present. The epiphyses have not closed.

Leg measurements were made:

	Left leg	Right leg
Anterosuperior iliac spine to internal malleolus	21.75 inches	19.75 inches
Superior border of patella to internal malleolus	11.25 inches	10.375 inches

A carefully made roentgenogram showed that practically all the lengthening was in the affected tibia, the patellar border measurements being uncertain on account of changed relation of the insertion of the patellar tendon.

Some time later this left tibia was exposed and a wedgeshaped piece of the shaft was excised from one

epiphyseal area to the other. The cortical bone was found to be very dense and thick and was deformed by anterior bowing and only one cloaca was found, near the persisting sinus. The original medullary cavity of the bone seemed to be nearly obliterated. There were small cavities containing pus and granulations, conforming to the X-ray evidence. Near each epiphysis was found pus, but no other gross change was discernible in these areas. A small amount of bone was removed from the upper epiphysis for microscopic study, and the wound on the leg was left widely open. The child is now convalescing.

Microscopic sections from cancellous bone removed in the juxta-epiphyseal areas show merely inflammation of bone. Because the epiphyses appeared quite normal in the roentgenogram, I did not feel warranted in removing any of the cartilage plate, even for microscopic study, fearing a spread of infection with possible unhappy result.

CASE 3. M. N., female, age 19. When this woman was 2 years old she caught her right leg and knee between the spindles of a stair rail. Before she could be helped she wrenched her leg free from its position. Acute swelling of the knee joint with loss of use followed immediately. Her parents were told that there was "water on the knee" and eventually as the swelling did not subside, the leg was put in a plaster-of-Paris dressing. Later pain and loss of range of motion developed in this knee and the child walked with lameness. She was then, over a course of several years, treated by injections into the joint after a diagnosis of tuberculosis of the knee.

At her examination it was found that, although her lameness had been attributed to a shortening of the injured leg, this leg was really longer than the opposite leg. She complained of pain in the knee joint after excessive use; none after rest. The knee joint seemed to her to be slightly swollen and her leg was somewhat clumsy. The reactions after the many joint injections had always been painful. The left knee and leg were normal. The right thigh showed some atrophy in its whole length, but there was no paralysis of any muscle. The knee joint appeared full in front but there was no fluctuation in the joint, the apparent swelling being the result of a beginning posterior subluxation of the tibia on the femur. The leg could be passively and actively flexed nearly to a right angle and extended to 170° without any pain. Jars of the joint were also painless but long use set up pain. There had never been any sinus or discharge from the knee or leg. A general physical examination was negative except the right leg, which bore no scars.

Measurements made showed that the whole right leg was 1.5 inches longer than the left. When the thighs were measured from anterior superior iliac spine to the lower border of the patella there was the same difference of 1.5 inches, the right being longer. The legs, as from the lower patellar border to the internal malleolus, seemed to be of equal length. She was unable to extend completely the leg on the thigh. Before the roentgenogram was taken, it was felt that the total increase of 1.5 inches in length of the leg lay in the femur. The roentgenograms showed considerable difference in size of the bones in the right leg as compared to the left. The bones were larger, probably because they had been called upon to perform most of the work of weight bearing. She acknowledged that for many years she has had to favor her leg in use. The spine and pelvis were found to have compensatory changes allowing for the longer limb, so that she walked quite uprightly with level shoulders, but with lameness.

Around the knee joint from the epiphyseal area of the femur, including the patella and the head of the tibia, there were marked changes of osteo-arthritis with new bone formation. On lateral view the joint surface seemed obliterated but the anteroposterior view showed a clear joint surface considerably narrowed, however, as compared to the normal knee. This is partly the result of the mild degree of subluxation present.

The epiphyses appeared to be closed. The transverse axis of the knee joint was slightly tipped, the inner tuberosity of the tibia appearing broadened and flattened down a bit. On the joint surface of the internal femoral condyle appeared a faint line as though a small fragment of bone and cartilage had been separated. The tibial spines were fairly clear. There was no evidence of cavity or sequestrum formation in the joint ends of the bone and only a very slight evidence of sclerosis on the outer sides. It is noticed, however, that the distance from the head of the fibula of the injured leg to the knee joint surface of the tibia is much greater than in the normal joint, as if the tibia had grown on away from the head of the fibula. This would appear to negative in part at least the clinical finding that practically all the increased leg length lay in the femur. The stimulating result of the trauma and subsequent blood effusion and joint injection appeared to have influenced both femur and tibia to overgrowth, the former more than the latter. The soft parts showed a shrinkage.

Here are three instances of overgrowth of a leg; of long bones. In two we find distinct evidence of an acute infectious process involving the shaft of the tibia, starting in childhood. In the first patient after 38 years, there was an appreciable lengthening limited to that part of the limb at first involved. There was a fresh area of dead bone in the upper epiphysis at the time of amputation—too late to have any bearing on long since ceased growth. The *lower* epiphysis had fused in with the talus.

The second patient, only 5 years old, showed a marked overgrowth in the infected bone after 1 year. But neither epiphysis seemed directly

involved, although pus and granulations were found near them. The third patient probably suffered a trauma to the femur (or tibia, or both) at the tender age of 2 years. Probably the lower femoral epiphysis was started out of its place—certainly enough to induce a quickly forming hæmarthrosis. By use and irritation, especially later irritation during the growing period by injections into the joint, an overgrowth resulted. Whether the epiphysis of femur and tibia took on excess growth because of the original trauma and had that action prolonged and aggravated by the chemicals injected into the joint and there absorbed, cannot be stated. But overgrowth far exceeding any natural difference in limb length, coupled first with inflammation, possibly tuberculosis, new bone formation, and later with restricted motion and possible bone separation in the joint surface with beginning subluxation, has resulted.

Was the irritant in the first two patients chemical and toxic yet stimulating, the results of pyogenic products, and was the irritant in the third patient trauma or trauma plus irritation of slightly misplaced epiphysis with blood effusion, chronic inflammation, and chemical injection? I am eager to know. Reverting again to Macewen's ideas on bone growth we might consider that the mechanics of the lack of use had some bearing on the lengthening.

The bones being freed from complete weight bearing, lay for long periods without mechanical use. We notice constantly that this leads to atrophy of disuse with lessened bone density, that is, loss of calcium salts. But these same bones which may undergo atrophy of disuse when lying so long without exercising their supporting mechanical function might respond very readily to stimuli which would lead to overgrowth in length. It is noticed that adolescents confined to bed for long periods, on account of acute illness, will grow in height an astonishing amount in a short period of time. This may also explain why the companion bone (fibula) grows along at the same rate of overgrowth, although it is not infected. It is also possible that it is dragged along by the tibia through its attachments.

TREATMENT

For overgrowth, apparently dependent upon osteomyelitis, we can advise simply adequate treatment of the osteomyelitis with attention to avoidance of contractures and *with early restoration of weight bearing*. If the patient is very young, as my second patient, a portion of bone shaft might be resected in another bone (femur) to equalize the leg lengths if non-union following resection of the infected bone were to be feared. This would avoid the other skeletal changes involving pelvis and spine. If the patient has reached maturity and no further bone growth is expected, the skeletal changes are probably permanent and no equalization of limbs would restore them to normal. Attention in such an instance might be directed toward increasing joint function if it were interfered with. Amputation would be considered only in the long-standing intractable cases with serious complications and as a life-saving measure.

CONCLUSIONS

1. Overgrowth of long bones apparently may follow infections of those bones, the infections not necessarily involving the epiphyseal areas.

2. Overgrowth of long bones apparently may follow epiphyseal displacements, of even slight degree.

3. Every patient with osteomyelitic epiphyseal disturbance of long bones should receive an early diagnosis and thorough conventional treatment, and each patient should be warned that growth disturbances, either undergrowth or overgrowth may result. Use and weight bearing on the limb should be restored at the earliest possible moment.

FIBRO-LIPO-SARCOMA OF THE SPERMATIC CORD

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CAREFUL survey of the literature reveals comparatively few cases of spermatic cord tumors, and for this reason the following case is presented.

The patient, a switchman, age 47, came under observation in November, 1920, with the history that 6 years previously, while working as a switchman, he was injured in the left inguinal region. Shortly afterward a small hernia appeared at the site of injury. He was operated on, the sac located and ligated, and the hernia repaired according to the usual technique. He was free from trouble for 4 years, when he noticed a very hard swelling in the left scrotum. This gradually increased in size and at the time he came for examination the tumor was about 6 inches long and 4 inches wide. It was hard, not painful on pressure, no impulse could be felt, and the transillumination tests were negative. The tumor mass and induration of the spermatic cord seemed to extend as far as the external ring, although the main body of tumor was in scrotum.

Operation was performed November 19, 1920. An incision was made in the scrotum over the tumor mass through the dartos and tunica vaginalis. Apparently two or three other sacs were cut before the tumor mass became visible. The tumor mass was aspirated but no fluid obtained. The testicle was found on the inner side of the tumor and except for a slight increase in size, was apparently normal, but the cord and vessels were hopelessly lost in the tumor mass itself. The incision was carried upward through the external ring into the inguinal canal. Here a slight peritoneal sac was found. The sac was opened but no bowel or omentum could be found. The sac was ligated and dropped back into the abdomen. The entire cord was cut transversely at the inguinal canal and removed with entire tumor mass from scrotum, and testicle was also removed. The bleeding points were ligated and dartos and skin sutured. The tumor is the shape of a kidney with the hilus in which the blood vessels enter. It is pale yellow, smooth, and covered by a thin, transparent, glistening membrane. It is hard and resists considerably to cutting. It is 14 by 9 by 9 centimeters and weighs, with the testicle included, 1½ pounds. The cut surface shows the upper one-fourth of the tumor to be very firm and pink, and the lower three-fourths less firm and pale yellow, but there is no definite line of demarcation. The pale portion is divided by fibrous septa into small lobules of about pea size. The testicle is free and slightly larger than normal, and the cord runs along the hilus of the tumor and is slightly enveloped by the tumor mass in the upper portion; however, the cord can be resected and is not included in the tumor proper.

Microscopical description. About three-fourths of the tumor mass has the character of a lipoma, but there are fibrous septa running into the tumor mass which show a sarcomatous infiltration. The rest of the tumor mass is a mixed cell sarcoma with abundant deposition of collagen fibrilli which show in scattered portions hyaline changes. Even the more solid tumor mass shows areas of lipomatous tissue scattered in places. There is a fairly good blood supply. The cells vary greatly in size, shape, and staining properties. The predominating cells are small, round cells. Some of the nuclei stain faintly and some very deeply. There are cells with huge, faintly staining nuclei about 12 microns in size; and also cells with an irregular, deeply staining cytoplasm. Atypical mitosis can be seen in numerous places. The testicle shows a marked increase in interstitial cells. The epididymis shows a proliferation of epithelial lining.

Diagnosis. Fibro-lipo-sarcoma, the lipomatous element predominating.

Tumors of the spermatic cord are comparatively rare and very little is known of their etiology. Lipoma, myoma, myxofibroma, dermoid cyst, sarcoma, and carcinoma are the ones most frequently met with. Hæmatoma of the spermatic cord has been reported. Of the benign growths, lipoma is the most common, while sarcoma occupies first place in frequency among the malignant growths.

Numerous theories are advanced regarding the etiology. Some authors claim that injury is the predisposing factor, others state that these tumors are secondary to similar growths in the testicle, and still others believe that the primary origin is in the cord itself. In 1909 Patel and Charlier made an exhaustive study of tumors of the spermatic cord and collected all the cases reported up to that time. They were able to find only 73 cases, of which 39 were lipomata, 4 mymota, 12 fibromata, 13 mixed tumors, 4 sarcomata, and 1 carcinoma.

In 1916 Brand[1] reported a primary perithelial sarcoma of the spermatic cord in a patient of 28, who complained of joint pains, and pain and swelling in the left testicle. An orchidectomy was performed. Two months later another growth appeared in the same location. At the end of a year he returned for

[1] Brand, A. New York M. J., 1916, civ, 454.

operation and at this time the scrotum seemed to contain two testicles; one was a mass the size and shape of a small egg in the stump of the left spermatic cord. The glands were not enlarged and the Wassermann test was negative. The tumor was removed and the patient made a rapid recovery. Pathological examination proved it to be malignant. As a very thorough examination of the testicle removed at the previous operation showed no malignancy, Brand assumed that the growth originated in the cord itself, possibly the result of the trauma produced by the suppurative process in the testicle and the surgical intervention.

Fox[1] reported a dermoid cyst of the spermatic cord in a young negro, who complained of joint pains, fever, sweats, and small, painless swelling in the inguinal region. This swelling finally reached the size of a pear. The tumor contained about 4 to 4½ ounces of white, flaky material and a lock of golden hair. Pathological diagnosis, dermoid cyst.

Schuzler[2] in 1916 reported a myoma of the spermatic cord in a man of 52 with a negative history excepting a hernia in childhood. At operation the tumor was revealed inside the tunica dartos and the vaginalis communis, bound down by several layers of taut membrane. Behind it was the vas deferens running unhindered down to the bottom. The tumor was round, rather knotty, weighed 62 grams, was the size of an apple, with almost the consistency of cartilage and was enclosed in a hard capsule. When cut it showed a light red color and was entirely solid, very much like a fibroma. Schuzler believes it is not possible to distinguish clinically between various intrascrotal tumors with absolute certainty and that any tumor of the spermatic cord should lead one to think of a myoma, no matter what the origin.

Lipomata of the spermatic cord were discussed rather fully by Schiller[3] in 1918, while Pluyette, and Bertin[4] reported a case in a man of 35 with a family history of hernia. The tumor was about the size of a walnut and painless. At operation it was found to be an extra-inguinal lipoma occupying the middle part of the cord.

Mayer[5] reported a myxofibroma of the cord in a man of 41 who had had a right-sided cryptorchism since childhood and at the time of examination was suffering from pulmonary tuberculosis. In 1917 he noticed a painless lump in the right inguinal region. A year later the tumor could be felt fluctuating both against the ground and the skin. A fibroma of the cord was diagnosed, with possibility of malignancy considered. Operation showed the tumor to be freely movable, together with cord. It was about 5 by 5 by 4 centimeters in size, with little lumps over the whole surface, and enclosed in a thin, transparent capsule. Incision showed that it was made up of clearly separated lumps, 1 to 3 centimeters in diameter. Microscopic diagnosis: myxofibroma.

Hæmatomata of the cord are of interest because they are so likely to be diagnosed as strangulated epiploic hernia. Martin reported two cases in 1919 and emphasized the necessity of a careful differential diagnosis.

The operative treatment in all tumors of the spermatic cord is complete enucleation. In the benign variety, the testicle and vas deferens can be retained while in malignant cases removal of these organs is usually necessary. According to Kocher, tumors of the cord can be divided into those located higher up, being only loosely connected with the wall because of a defect in the serosa, and those situated farther down in a limited portion of the tunica vaginalis, developing either into the spermatic cord or outward or even diffusely located in the propria testis and more or less covering the scrotum. The operative treatment, therefore, depends on the location and relation of the tumor to neighboring parts.

Little is said regarding the prognosis of these tumors. In the cases reported, no mention is made of unfavorable terminations. It is likely that the benign variety do not recur after having been completely removed and that the malignant type follow the same rule as do malignant tumors in other parts of the body. In our case there was no return of the tumor or evidence of metastases at time the case was reported, 2 years after operation.

[1] Fox, R. E. J. Michigan St. M. Soc., 1916, xv, 318.
[2] Schuzler, H. Deutsche Ztschr. f. Chir., 1916, cxxxv, 258.
[3] Schiller, Heliodor. Ann. Surg., 1918, lxviii, 269.
[4] Pluyette E., and Bertin, J. Marseille mèd., 1916-17, liii, 550.
[5] Mayer, Karl. Ztschr. f. Biol., 1919, xiii, 1.

A STUDY IN PUERPERAL MORBIDITY[1]

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IN the study of the incidence of morbidity in puerperal cases, it has been possible to cover a period roughly approximating 15 years, with a few cases from the year 1906, and practically all the cases following that up to and including 1921. There has been an effort to exclude all those case histories which do not have a rather careful description of the delivery and a record of puerperal temperature range. The result is that there were found available some 7,000 case records, evenly divided between house and out-practice. Of the 3,500 house cases, almost exactly 1,700 are primiparæ and 1,700 multiparæ, so that in all totals made the ratio has been considered equal. Among the out-practice cases, the ratio is about one primipara to four multiparæ, giving 700 primiparæ and 2,800 multiparæ in cases studied.

The purpose of the study to be made was two-fold. First of all there has been a careful statistical study of the incidence of morbidity in puerperal patients, with percentage estimations. There has been throughout a comparison of house and out-practice cases, and a comparative study of the three 5-year periods included in the time covered. In the second place, the purpose of the study is to analyze the cases of morbidity as to etiology, type of case, and mortality rate. Certain explanations are necessary, then, before any analysis of figures is made. The morbidity standard chosen is the English one and includes as morbid every case in which there is a rise of temperature to 100° F. or more for three successive days or longer. This standard quite definitely rules out a small class of cases where there has been a rise of temperature of only 1 or 2 days, but a temperature which seems puerperal in origin, nevertheless. On the other hand unless the 3-day standard be adopted, there would of necessity be so much ruling out of cases that clear-cut study would be impossible. In this connection all that will be said concerning the ruling out of cases in our study is that only an occasional non-obstetrical cause for temperature increase during the puerperium was found, and thus only an occasional case history ruled out.

In the grand total of 3,500 house patients, then, there have been found 300 cases of puerperal morbidity, a percentage morbidity of 8.6. Of these, 202 were primiparæ and 98 were multiparæ, a percentage incidence respectively of 11.5 and 5.6. In other words, puerperal morbidity is practically twice as common among primiparæ. Mortality in these house cases totaled 10—that is 10 whose deaths were due to puerperal sepsis. But it is only fair to state in passing that there has never been a death in the home caused by sepsis, and that among 3,000 deliveries, the records of which were not available for this study there is no other case of mortality from septicæmia. That is to say the 10 in 10,000 is the incidence of mortality from puerperal sepsis in all of the patients delivered since 1906.

On the out-practice there were 71 cases of morbidity in the total of 3,500, an incidence of 2 per cent. Twenty-three were primiparæ and 48 multiparæ, in spite of the fact that four times as many multiparæ were delivered during that time. Comparative percentages here are 3.2 per cent among primiparæ and 1.7 per cent among multiparæ.

Just a word as to the lower rate of occurrence among cases delivered in the home would not be amiss. It must be remembered that temperature records are made at least three times a day in the hospital, while only one visit a day is made to the average patient in the home. Then, too, the tendency has always been for any patients who are seriously ill to be moved from the home to the hospital, and the out-practice morbidity rate thereby decreased. Entirely aside from these somewhat mechanical factors, however, there is a well-known immunity, if you please, among the class of puerperal patients found in the average hospital, or teaching out-practice. Some one has said that the dirt in the home

[1] From the case records of Department of Obstetrics, Woman's Medical College of Pennsylvania, and Maternity Department of the College Hospital.

of the very poor is dirt, while the dirt in the hospital is germs, and that is about as scientific a dismissal of the facts as can be made.

Coming to a study of totals during each of the 5-year periods, the findings are as follows: In the house the first period yielded 740 available case records with 75 cases of morbidity, a percentage of 11.3. In the second period there were studied 921 case histories, with 90 morbid records and a resultant percentage of 9.7. The last period, ending with 1921, gave a total of 1,839 cases, 134 morbid ones, or 7.5 per cent. On the out-practice the first period gave 30 morbid cases in a total of 1,392, a percentage of 2.16. The second total was 21 morbid cases in 1,030, or 2.03 per cent. In the third period 1,078 records were examined, 18 morbid cases found, a percentage of 1.6. In other words, there has been a definite decrease in the incidence of puerperal morbidity both in the house deliveries, and those of the out-practice.

TABLE I.—GRAND TOTALS OF ALL CASES

	House			Out-Practice		
	Totals	Morbidity	Per cent	Totals	Morbidity	Per cent
Totals	3500	300	8.6	3500	71	2.0
Primiparæ	1700	202	11.5	700	23	3.2
Multiparæ	1700	98	5.6	2800	48	1.6
1906–11	740	75	11.3	1392	30	2.16
1911–16	921	90	9.7	1030	21	2.03
1916–21	1839	134	7.5	1078	19	1.6

Turning next to a division of cases studied into operative and non-operative deliveries, we find that there were altogether 2,886 non-operative deliveries in the house. Of these 161 showed a rise in temperature, a percentage of 5.5. Two of the fatal cases found resulted from non-operative deliveries. Of the 161 morbid patients 107 were primiparæ, and 54 multiparæ, giving percentages of 7.4 and 3.8 respectively. On the out-practice, 3,287 deliveries were non-operative and 54 of these morbid, 1.6 per cent. Fifteen primiparæ and 39 multiparæ gave respective percentages of 2.25 and 1.5. That is to say that in this division, as in the cases of all types, there is almost twice the morbidity with first deliveries that there is with second or later.

Among these non-operative deliveries, 627 of the house cases came in the period ending 1911, and of these 47 ran a morbid course, giving 7.5 per cent as the ratio. In the second period 761 patients were non-operative, 53 were morbid, and 6.9 per cent was the incidence. The third period gave a total of 1,498 patients and morbidity of 58, or 3.8 per cent. On the out-practice there were 1,315 normal deliveries with a morbidity of 24, or 1.8 per cent, before 1911. From 1911 to 1916 there were 959 cases with 15 morbid patients, a percentage of 1.5. And in the last period 1,013 records yielded 13 morbid cases, 1.28 per cent of the total. Here again, then, we find a definite steady decrease in the incidence of morbidity in each succeeding 5-year period.

TABLE II.—NON-OPERATIVE CASES

	House			Out-Practice		
	Totals	Morbidity	Per cent	Totals	Morbidity	Per cent
Totals	2886	161	5.5	3287	54	1.6
Primiparæ	1443	107	7.4	657	15	2.25
Multiparæ	1443	54	3.8	2630	30	1.5
1906–11	627	47	7.5	1315	24	1.8
1911–16	761	53	6.9	950	15	1.5
1916–21	1498	58	3.9	1013	13	1.28

Before turning to the study of operative cases, let us make some investigations of the patients who delivered themselves but who nevertheless ran a morbid course during the puerperium.

Of the 107 primiparæ, 19 had labors which would be called prolonged that is the second stage was more than 2 hours, or the first stage 20 or 24 hours or more. There was no effort to study the incidence of dry labor, but it undoubtedly had its effect. Dorman and Lyon made a study of some 300 cases of dry labor at the Woman's Hospital in New York and found an increase in morbidity from the general average of 17.5 per cent to 26 per cent in these 300 cases. (Report on Scientific Work of Surgical Staff of Woman's Hospital, 1920.) The 19 cases of prolonged labor give a ratio of 19 per cent, and certainly not one case out of five in all non-morbid primiparæ would have second stage of more than 2 hours. As to multiple vaginal examination, 18, or 17 per cent of the 107, had four or more examinations made, a ratio of one to six. And those of us who continue to prefer vaginal examinations must pause at that, for again it seems

improbable that in the general run of cases one primipara out of six has four or more vaginal examinations after she has fallen into labor. There is, then, just a warning in the figures found, low though they seem, and a lesson to be taught in that prolonged labor and repeated vaginal examinations certainly have an influence in increasing morbidity during the puerperium.

But gonorrhœa plays the largest part in this morbidity, and the numbers of the cases found were as follows: There were 23 cases where the bacteriological smear was positive, and 16 where the clinical diagnosis was such that no mistake could be made. This total of 39 cases is a ratio of 36 per cent showing morbidity because of presence of gonococcus. The significant factor here, too, is that there are very few, only 4 or 5, of the group of 39 which overlap the group mentioned above. That is to say that prolonged labor and repeated examinations are by no means necessary to produce a flare-up of gonorrhœa.

One or two examples of each type of case might be given.

This patient is one in whom one might expect a morbid puerperium.

Case No. 780. B.B., 18, para-I, colored, single. Position and presentation: vertex, left occipito-anterior. Labor: first stage, 48 hours; second, 6 hours; third, ¼ hour. Vaginal examinations: four in last 24 hours. Delivery: spontaneous. Temperature: 103, 102, 100.2, 101, etc. from third to sixteenth days. Symptoms: localized pain and tenderness, subinvolution.

Another:

Case No. 1450. M.B., 18, Irish, married. Position and presentation: vertex, right occipito-anterior. Labor: first stage, 10 hours; second, 1 hour; third, ¼ hour. Vaginal examinations: four in last six hours. Delivery: spontaneous. Temperature: 103.1, 102.1, 101.2, 103.1, 100.1, 101.1, 99.2 on fourth to tenth days. Symptoms: abdominal pain and tenderness; subinvolution.

One typical gonorrhœal case may be quoted.

Case No. 877. F.W., 18, para-I, colored, married. Presentation and position, vertex, left occipito-anterior. Labor: first stage, ?; second, 2 hours; third, 20 minutes. Delivery: spontaneous. Vaginal examinations: one. Temperature: 103.2, 104, 103.1, 104.3: 104.3, 103.4, 102, 101.2, 101.2, 102.1, 101.1, 99.2, 99, 98.2 on fourth to sixteenth days. Symptoms: very slight abdominal distention, no pain, general condition excellent. Cervical smear: Gram-negative diplococci, intracellular, morphologically gonococci.

One other type of case must be mentioned, although most careful search revealed only three which could be included. That is the case in which a diagnosis of pyelitis can be made—manifested by pain in back, some pain on micturition, and usually a tendency to chill at the time of temperature rise, with findings of pus in the urine. In the cases of our finding which can be included here, one had a definite cystitis before delivery, and in the other two there was no evidence of influence upon course of the case by prolonged labor, many examinations, or bacterial invasion of uterus of cervix.

Phlebitis, of course, claims a few, but here again the number is small, only four being found in which such diagnosis was made.

Just a word as to the very serious cases and those in which death occurred. In Jellett's *Midwifery* there is the following rather telling quotation from Smyley: "If a patient with a high temperature looks well, sleeps well, and says she is well, she is, at any rate, not septic. If a patient with a high temperature looks very ill, sleeps very badly, and says she feels very ill, she generally is very ill. If a patient with a high temperature looks very ill, sleeps very badly, but says she feels very well, she will probably die." With that as something of a standard, there are few cases in the non-operative class which can be considered serious. The charts of some of the 8 gonorrhœal cases look startling, with temperatures of 105, 104, or even 106 or 107, as no uncommon findings, but almost as startling is the regularity with which the resident has noted no symptoms, or failed to note even the temperature at all in her record because the patient herself refused to admit that she was ill. Therefore, so near as we can judge, the seriousness of the case by the combined impression of the temperature chart, and the faithfulness of the resident in making unusually careful daily notes on her most seriously ill patients, we find only four cases which it seems permissible to call serious infections.

Two of these were fatal. Of the other two, one ran a high septic temperature for a week, developed a septic rash, but went on to recovery. The second had a septic temperature for 2 weeks, had frequent chills, much abdominal pain and tenderness, and also a septic rash. She too went to recovery. The first of the fatal cases was one in which there was a definite kidney condition before delivery. She delivered herself without difficulty, but on the fourth day of the puerperium developed a typical streptococcic septicæmia,which caused her death on the eleventh day. The second patient showed no prenatal complication, and delivery was normal and very easy. She, too, had a typical streptococcic infection in which double lobar pneumonia was the terminal condition, but which was undoubtedly puerperal in origin.

Such an analysis as the above leaves some 35 cases of morbidity unaccounted for in any way, 33 per cent of the primiparæ. These are those patients who were delivered after short, easy labors, or self-delivered, with no evident reason for infection. But they are, nevertheless, definitely a part of every maternity ward's morbidity statistics and as such stand as the unsolved problem in those statistics.

In a little less detail, let us look at the 54 multiparæ, non-operative, who ran morbid temperatures in the house. Among these, there is no evidence whatever of prolonged labor or repeated examinations as a factor, and only some three or four had more than two examinations. There are not many cases which can be called serious either, and no fatalities. One patient who had a smear showing gonococci had a subsequent peritonitis which was serious but recovery followed. Another had an unidentified infection which caused a definite peritonitis of 8 days' duration, but her recovery was rapid. The third serious case showed a positive blood culture, and clinical evidence pointed to fresh vegetation on the aortic valve. But she, too, recovered, though she was in the hospital 6 to 7 weeks, and had not too good a heart on discharge.

Eight of these patients showed a positive smear for gonococci, one had pyelitis, and two seemed to have had retained clots which accounted for the temperature range. There are, therefore, 38 of this group, 66 per cent, who ran mild courses, but who stand in the problematical group of puerperal morbidity.

On the out-practice conditions are much the same:

Of the 15 primiparæ there were 3 cases positive of gonorrhœa, 2 clinically positive, while long labor was present in 2, and more than four examinations were made in 4 cases. There were no serious cases and there are about 8 where the etiological factor for increased temperature is unknown.

The 39 multiparæ records are as follows: There were no serious cases and no fatalities. In two and four cases respectively there is a history of long labor and more than four examinations. Three patients had positive smears, and six ran courses clinically gonorrhœa. As for the other 25 cases, 66 per cent, there are various reasons for fever, evolved by fertile brain of student or interne, varying from dietary indiscretions, and alcoholic intoxication, to doing family washings on third or fourth day of puerperium. Whatever the explanation made, here again are those unaccounted-for cases which remain in the category of the unknown.

In the field of operative deliveries we find the most frequent occurrence of patients whose temperature is increased during the puerperium. In the house during the time covered there have been 614 patients for whom operative procedures were necessary, 351 of them primiparæ and 263 multiparæ. One hundred and forty-one of these 614 patients are classed in the morbidity group, or 22.9 per cent. Of the 351 primiparæ 26.5 per cent were morbid, and 18 per cent of the multiparæ. Eight of the 10 fatalities mentioned before occurred following operative procedures on house patients, or patients who died in the house.

Two hundred and thirteen out-practice patients underwent operative deliveries or procedures of various sorts: 40 primiparæ and 170 multiparæ. The percentage morbidity was 8 per cent as a total, or 17 patients. Eight primiparæ yield a percentage rate of 20, as compared with 9 multiparæ and 5.3 per cent.

Comparing the 22.9 per cent incidence in the house with the 8 per cent on the out-practice it looks three times as safe to resort to operative procedure in the home. But there is the important point always to be considered that so far as possible the more serious procedures are done only in the house, and of course all cæsarean sections come in the house statistics. But even discounting all of that, there is the same factor of immunity if it can be so called, among the patients in slum districts which we mentioned above.

In the 5-year period there has been less decrease in postoperative morbidity than in either of the other comparisons made. Of 113 house operations before 1911, 28, or 24.7 per cent, caused morbid puerperia. From 1911 to 1916, 37 out of 160, or 23.1 per cent, came into the morbidity statistics. And in the last period 76 out of 341 make the percentage 22.2. On the out-practice 6 of 77, or 8 per cent; 6 of 71, or 8.4 per cent; and 5 of 65, or 7.7 per cent, are the figures.

TABLE III.—OPERATIVE CASES

	House			Out-Practice		
	Totals	Morbidity	Per cent	Totals	Morbidity	Per cent
Totals	614	141	22.9	213	17	8
Primiparæ	351	93	26.5	40	8	20
Multiparæ	263	48	18	173	9	5.3
1906–11	113	28	24.7	77	6	8
1911–16	160	37	23.1	71	6	8.4
1916–21	341	76	22.2	65	5	8.7

Some classification of types of operation and the risk attached to each is important. In order of morbidity rate, the house cases are shown in Table IV. The first number in each line is the total number of times that operation was performed, and the second the morbidity, with the percentage following.

The figures as given speak largely for themselves and little amplification is necessary. The sequence found seems quite in line with the teaching one receives. The place of cæsarean section practically midway down the list occasions a little surprise until one remembers that in a clinic where a fairly large proportion of the patients are receiving prenatal care, cæsareans are rather regularly performed without endangering the patient's recovery by unwise management before the section is

TABLE IV.—HOUSE CASES

	Operation	Morbidity	Per cent
Intra-uterine packing	9	6	66⅔
Intra-uterine douche	14	8	58
Version and extraction with craniotomy	12	6	50
Multiple (three or more procedures)	21	9	43
Manual removal of placenta, following other procedure	88	31	35
Insertion of bag followed by other procedure	32	12	35
Cæsarean section	42	16	33
Version and extraction	88	23	28
High forceps	85	22	26
Mid-forceps	68	17	26
Breech extraction	85	15	16
Low forceps	123	17	10
Manual removal of placenta	46	5	10
Insertion of bag	59	3	5

TABLE V.—OUT PRACTICES CASES

	Operation	Morbidity	Per cent
Intra-uterine douche	5	2	40
Version and extraction with craniotomy	3	1	33⅓
Manual removal of placenta following other procedure	31	5	16
High forceps	28	3	11
Mid-forceps	27	3	11
Manual removal of placenta	55	5	9
Low forceps	31	1	3
Version and extraction	40	1	2.5
Breech extraction	42	1	2.4

decided upon. Even so the mortality risk to be discussed later puts a little different light on the subject. The comparative innocuousness of manual removal of the placenta, especially in the house is hardly to be expected if one reads various textbooks in obstetrics, with their dire warnings against that procedure.

A discussion of the various individual cases in the operative field would be of interest. But each is so different from each other that typical cases cannot be cited. Suffice it to say that gonorrhœa plays its large part here, too, as an etiological factor in rise of temperature. And pyelitis, phlebitis, and severe generalized infections are present. The severe cases are much more frequent than in the non-operative field, and the recovery of some of the patients seems most remarkable. But here again there is a host of case records in which a questionmark is the only cause recorded for the fever of the puerperium.

Just a word must be said of those patients who died of sepsis following operation. In point of numbers the operations follow:

Intra-uterine packing	2 of 10
Version and extraction with craniotomy	1 of 12
Cæsarean section	2 of 42
Breech extraction	1 of 85
High forceps	1 of 85
Version and extraction	1 of 80
Post-partum curettage	1 of 1

In two of the above cases manual removal of the placenta was done in addition to operation listed and in two more some third procedure had been used. The only comment that seems necessary is to call attention to the fact that in 8 out of 10 fatalities there was an operative delivery, and that the operative procedures were in almost all cases of the more prolonged and serious type. In other words, these few fatal cases teach even more emphatically than do the morbidity statistics that operative deliveries are dangerous, and are highly undesirable if we are anxious over mortality or morbidity statistics among puerperal patients.

CONCLUSIONS

1. Total morbidity was 8.6 per cent in house and 2 per cent in out-practice cases.

2. Morbidity was nearly twice as common in primiparæ as in multiparæ.

3. Total morbidity percentages have shown a steady decrease by 5-year periods both in house and on out-practice.

4. Total mortality from puerperal sepsis was 10 in 10,000 cases.

5. Morbidity in non-operative cases was 5.5 per cent of cases delivered in the house and 1.6 per cent of out-practice.

6. There was definite increase in morbidity among non-operative cases in primiparæ as compared with multiparæ, and the influence of long labor and repeated vaginal examinations can be traced.

7. There is either bacteriological or definite clinical evidence of gonorrhœa as an etiological factor in puerperal infection in 36 per cent of the primiparæ and 20 per cent of the multiparæ.

8. There is a large class varying from 33 to practically 75 per cent of the total patients in whom the course of the reaction was very mild and for which no definite etiological factor could be found.

9. Morbidity percentage has shown a steady drop by 5-year periods in non-operative cases, both in the house and on the out practice.

10. Mortality rate has been 2 in 2,886 house cases and none in the out-practice, non-operative.

11. The percentage morbidity in cases where operative procedures were used was 22.9 per cent in the house, and 8 per cent on the out-practice.

12. The incidence of postoperative morbidity was from 2 to 4 times as great in primiparæ as in multiparæ.

13. The drop in the incidence of post-operative morbidity has been less than that of non-operative morbidity, but has occurred.

14. The operative procedures as to morbidity incidence show the following sequence: intra-uterine douche; version and extraction with craniotomy; manual removal of placenta following some other procedure; insertion of bag followed by some other procedure; cæsarean section; version and extraction; high forceps; mid-forceps; breech extraction; low forceps; manual removal of placenta; insertion of bag. We find that the sequence on the out-practice is practically the same.

15. The operative procedures which have been followed by fatalities have been the more serious prolonged type, and multiple procedures have been common.

TUBAL TWINS AND TUBAL PREGNANCY[1]

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INTRODUCTION

ECTOPIC gestations are classified on the convenient basis of location. Since primary ovarian and abdominal pregnancies are rare and the uterine tube is the natural site chosen, the adjective "extra-uterine" or "ectopic" is usually understood to connote primary tubal implantation.

Besides the ordinary plural pregnancies within the uterus there are occasional cases of plural gestation in one or both tubes, or combined simultaneously in uterus and tube. Seven is the greatest authentic number of uterine births at one time (Parker, 1914); within a tube three and five equal fetuses have been found.

The several types of pregnancy allow of systematic arrangement. The following grouping is suggested as a convenient way of expressing these relations.

CLASSIFICATION OF PREGNANCIES

I. *Uterine*
   1. Simple (i. e., single);
   2. Successive (superfetation);
   3. Twin, etc.

II. *Tubo-uterine* (combined uterine and tubal)
   A. Unilateral (uterus and one tube)
      1. Simultaneous
         a. Twin; b. triple, etc.
      2. Successive
   B. Bilateral (uterus and both tubes)
      1. Simultaneous
         a. Triple, etc.
      2. Successive

III. *Tubal* (including interstitial)
   A. Unilateral
      1. Simple;
      2. Successive;
      3. Twin, etc.
   B. Bilateral
      1. Simple;
      2. Successive;
      3. Twin, etc.

IV. *Ovarian*
   1. Simple;
   2. Successive;
   3. Twin.

V. *Abdominal*
   A. Primary
      1. Simple;
      2. Successive;
      3. Twin.
   B. Secondary
      1. Simple;
      2. Successive;
      3. Twin.

It is suggested that "tubo-uterine" designate a simultaneous pregnancy in both uterus and tube. This would replace such cumbersome terms as "intra-extrauterine," or "combined uterine and extra-uterine." It seems preferable to refer to twins in one tube as a "tubal twin pregnancy," and the fetuses themselves as "tubal twins"; since "twin tubal pregnancy" has been used both as a synonym for the foregoing condition and also to designate the occurrence of one fetus in each tube (bilateral tubal pregnancy), it is better avoided altogether. The inclusion of "successive pregnancies" is necessary to cover those cases in which a second gestation occurs in women already pregnant or still carrying the dead product of a former conception. This introduces the vexed question of superfetation; however, such provision must be made, for this type, although undoubtedly very rare and most records spurious, cannot be ignored as a possibility.

THE LITERATURE ON TUBAL TWINS

The commonest plural pregnancy that involves the uterine tubes is the combined tubo-uterine type. According to Cameron (1906), Vilsin recorded 65 cases (in 25 of which the tubal fetus reached maturity!). In 1905 Weibel had collected over 119 cases, although it is probable that some of these are merely presumptive and not all are twins. Plural

[1] Contribution No. 91.

gestation in the same tube is next common. Pulcher (1905) found 18 examples; Costa, in 1907, listed 11 cases which he considered certain and added 15 presumptive cases; McCalla (1909) cites 25 positive cases; Pool and Robbins (1910) give 26 positive cases and reject 18; Hardouin (1919) enumerates 37 as positive and eliminates 13 as spurious. Rarest are bilateral tubal pregnancies. Although McCalla (1909) collected 37 cases and McDonald and Krieger (1913) list 25 proved and 27 probable specimens, less than a dozen of these actually are twins.

In another publication (1923 *a*) I have examined fully the literature of unilateral tubal twin pregnancy and have extracted therefrom 38 positive or authentic cases, 8 probable or presumptive cases, and 4 possible but doubtful cases. The positive list is there increased by two new specimens and critical summaries of all previous cases are appended.

AN ANALYSIS OF TUBAL PREGNANCY

Critical examination of the data of tubal twinning, recorded in full elsewhere (1923 *a*), yields numerous interesting facts;[1] the remainder of this report will be devoted to an analysis of these relations and the inferences to be drawn from them.

1. *Age of the mother.* First to be considered is the age of the mother. What time-relation does it hold to the mean age for ordinary uterine births? A norm may be established from the birth statistics of the United States Bureau of Census. These include the ages of the 4,080,879 women in the registration area (55 per cent of the total population) who became mothers during the years 1917–1919. Converted into percentages such figures may be stated as follows:

Age	Per cent	Age	Per cent
10–14 years	.06	35–39 years	11.5
15–19 years	7.7	40–44 years	3.9
20–24 years	27.5	45–49 years	4.0
25–29 years	26.9	50–54 years	.01
30–34 years	18.4	55– years	—.01

Assuming that the middle year represents with sufficient accuracy the mean for each of these five-year groups[2] it appears that the average age for childbirth in the United States is 26.5 years.

It is interesting to compare these results with those found in 47 cases of single tubal pregnancies[3]:

Age	Per cent
20–24 years	10.7
25–29 years	36.2
30–34 years	23.4
35–39 years	21.3
40–44 years	8.5

The mean age is 31.0 years, or 4.5 years later than the average for normal uterine births. The modal period is between 25 and 29.

If the ages of the mothers (in 41 instances this information is furnished) in my list of tubal twins[4] be similarly tabulated the distribution is:

Age	Per cent
20–24 years	9.8
25–29 years	29.3
30–34 years	39.0
35–39 years	17.1
40–44 years	4.9

The mean age is again 31.0 years, or 4.5 years later than the average for uterine births. The precise agreement in the ages of the mothers of tubal single pregnancies and tubal twins is to be expected since most of the twins are monochorial and the conditions therefore identical. Moreover, there is no divergence in the six cases of double ovum twins for the average of these is 30.9 years. The modal period, however, is between the ages of 30 and 34; this is one group later than in single tubal pregnancies. The grand mean of both single and plural groups (88 cases) establishes 31.0 years as the average age for tubal pregnancies in general. The interpretation of this delay of 4.5 years will be considered (see following page) as soon as certain allied relations have been presented. These facts pertaining to age distribution are shown graphically in Figure 1.

[1] Especially notable as curiosities are the quintuplets of Treub-Cullen (1910), the unilateral triplets of Diamant (1914) and Krusen (1902) (and possibly Saenger, 1893?), and the bilateral triplets of Baldwin (1913) and Launay (1910) (and possibly Carstens, 1920, and Johnson, 1894?). The tubal thoracopagus of Kirchoff (1894) is unique.

[2] The reports cover these 5-year groups only. As errors in the extreme groups introduced by this assumption roughly balance, the computation is doubtless approximately accurate.

[3] In 1915, Mall published a monograph on the fate of the ovum in tubal pregnancy. As an appendix were recorded descriptions and available histories of the 117 specimens that formed the basis of his report. This material represents the tubal pregnancies in the first thousand specimens of the Carnegie collection. Fifty cases which have reasonably adequate clinical histories I have tabulated for use in the present publication. These will be referred to as the "single series" (of tubal pregnancies).

[4] Only the 47 positive and probable cases will be drawn upon. These cases will be referred to hereafter as the "twin series."

2. *Previous births and abortions.* Equally significant is the number of children already born to these mothers, and the frequency of abortions. In the single series 13 cases state there were no children; the 36 mothers total 71 births. In the twin series there are 8 cases with the absence of children clearly stated; 25 women had become mothers, the number of children equalling 50. Combining these data, which are in essential agreement, it appears that three-fourths (74.4 per cent)[1] of women having tubal pregnancy are already mothers; nearly half (44 per cent) are multipara and the average number of children (to all who are mothers) is exactly two.

Abortions are common. In the single series 33 abortions are recorded for 14 cases; absence of abortion is stated in 21 cases. In the twin series there were 18 abortions in 9 cases; its absence is mentioned in 6. Combining gives a total of 51 abortions in 23 women, 17 of whom were also mothers. It follows that not only abortion but repeated abortion commonly appears in these histories.[2]

3. *The sterile period.* Another important correlation is the elapsed interval since the last pregnancy (normal or abortion), or since marriage among nullipara. In the single series this interval for 44 cases averages 5.6 years; included are 10 women who never before had been pregnant, the mean interval since marriage being 6.2 years. In the twin series (29 cases) the average interval is 6.2 years; seven of these individuals were nullipara, never before pregnant, whose average married life had been 6.6 years. Combining both single and plural sets of 73 cases gives a mean interval of 5.8 years since marriage or the last pregnancy. Of the 17 who had never previously been pregnant, an average of 6.4 years had elapsed since marriage.

The explanation of this sterile interval is a corollary to the explanation of tubal pregnancy itself. Mall's (1915) intensive studies with the unique material at his disposal point clearly to tubal inflammation as the chief factor in tubal gestation. It appears that an inflammatory condition may prevent pregnancy for a variable period, either by mechanically blocking fertilization or by causing young ova to disintegrate. After a time when the inflammation has largely abated, the tube becomes a possible nidus for the growing ovum, which, nevertheless, is still unable to reach the uterus. If tubal pregnancy does not then occur, it is believed the tube later may become sufficiently healed to allow fertilized ova to pass to the uterus in a normal manner. In other words the chance of incurring tubal pregnancy is least under two extremes; either when the tubes are normal, or when they are so affected as to prevent conception entirely or destroy its product early.

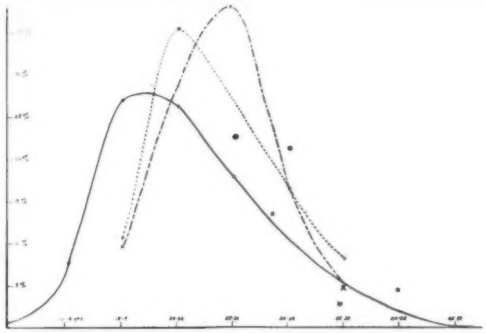

Fig. 1. A graph showing the relation between the mother's age and the percentage frequency of births: ———, single uterine births; – – – – –, single tubal pregnancies; ———— —, twin tubal pregnancies.

This course of tubal inflammation, for which there is direct proof, adequately explains the prolonged sterile period that so often precedes tubal pregnancy, the consequent greater age of women having such ectopic gestations, and the frequent termination of the sterility by tubal implantation. The preponderance of cases among women who are already mothers and the added facts that two-thirds of these are multipara, evidently signifies that elapsed time and the cumulative hazards of marriage and motherhood are favorable to the acquiring of infections. The relative frequency of abortions, most of which are remote in time, perhaps denotes earlier mild attacks or onset of a condition which thereafter tightened in the tube and caused the period of prolonged sterility.

[1] Whether relatively more histories neglect to mention the absence than occurrence of children is doubtful. Probably the percentage stated is approximately correct.

[2] Many histories give no information on this point so the absolute frequency is obscure. De Lee's (1918) practice has yielded 24 per cent, which he considers below the actual frequency.

4. *Summary regarding the mother.* The foregoing analyses may be brought together in a generalization. Tubal pregnancy (single and plural) tends to occur in women who are older by 4.5 years (31.0 years) than the average age for motherhood (26.5 years). These women fall into two groups: (1) Three-fourths are already mothers (but without recent pregnancies) and nearly one-half are multipara; previous abortions are common. (2) One-fourth have been married a relatively long period without becoming pregnant. The sterile period since marriage or the last pregnancy averages nearly 6 years.

5. *Frequency of rupture.* A natural query is whether tubes which bear twins are more likely to be ruptured at the time they come to hand than are single tubal pregnancies. Mall (1915) found, among the records of Dr. Kelley's laboratory, 128 cases of tubal pregnancy carefully described. Of these 82 had ruptured previous to the operation while 46 were unruptured. Furthermore, in the Carnegie single series there are records of 49 ruptured[1] and 49 unruptured[2] cases, distributed unequally among three general groups. The specimens containing normal embryos include 20 with rupture and 9 without; of those having pathological embryos the representation is 8 and 8; the remaining group, which comprises degenerating ova without embryos, yields 21 ruptured cases against 32 unruptured.

It will be noted that the greatest frequency of rupture occurs in tubes containing normal embryos, next come tubes with pathological embryos, and lowest are those without embryos but containing degenerating ova. The percentages of rupture in each of these groups are respectively 69, 50, and 40. This means that a growing normal embryo in the tube is an especial menace due to its greater probability of causing rupture. Embryos which are pathological tend to remain small or to degenerate; the severity and rate of these changes depend on the relative fitness of the tubal mucosa to receive the ovum; in general, the more severe are the conditions inducing atrophy, dissolution, and absorption, the less is the danger of rupture. Manifestly, to indicate the true frequency of rupture the many small specimens wh ch represent ova undergoing atrophy and resorption should be included; these often are not recognized or are believed to be without value or interest. The Carnegie series does include many such, and Dr. Kelley's list of 128 contains 39; when these two sets are combined the ratio of rupture to non-rupture becomes 131:95, or 58 per cent. This represents the best approximation available.

In the twin series with single chorionic sacs, 28 cases mention rupture and 7 its absence. The 80 per cent ruptured at first appear to indicate that tubal twins in the same sac do burst more frequently than single pregnancies (58 per cent). However, this rate is undoubtedly too high, since it is obviously impossible to identify and include as monochorial twin specimens those degenerating ova, without recognizable twin embryos, which rightly belong here. Furthermore, surgeons doubtless fail to identify markedly pathological twin specimens; at least such have not been reported. Since the figures just derived show that less than 50 per cent of tubes without normal embryos rupture, and our list lacks a proper representation of these, the unreliability of the higher ratio of rupture among monochorial twins becomes apparent. Theoretically a somewhat greater frequency might be expected. This, however, would be due to placentation and its sequelæ, not directly to abnormal stretching of the tube by twins, as Martin (1895) feared; at the time rupture is most likely to occur the twins do not even crowd the chorionic cavity (Arey, 1922 a). Various cases corroborate this view. Lucas-Championnière (1903) records twins of 8.0 centimeters in an unruptured sac, while in Braham's (1914) specimen rupture was delayed until during the sixth month. It is also clear that pressure may flatten one or both fetuses without producing rupture; in Robinson's (1892) case both 13 centimeter fetuses were compressed; in Rupin's (1860) there were a 6 months' fetus and the bones of a 4 months' one; Folet's (1896) specimen contained a full term fetus and one of 3 months greatly flattened; Minchinard (1896) described a ruptured tube which had held an 8

[1] Excluding tubal abortions.
[2] Including three at the point of rupture.

months' fetus and a flattened fetus of 6.5 centimeters. The two authentic cases of unilateral tubal triplets (Krusen, 1902; Diamant, 1914) ruptured at about the tenth and eighth week respectively, whereas the average time for single specimens is 7.7 weeks (cf. following topic).

6. *Time of rupture.* Closely associated with the last topic is the time of rupture of monochorial twins and its relation to rupture in single specimens. In the single series the average time of rupture for 25 cases is at 7.7 weeks. The corresponding figure for 28 cases in the twin series is 10.9 weeks. Perhaps the older specimens are more faithfully recorded in the twin series due to the unusual feature of twinning; on the contrary fewer old and bulky specimens are doubtless sent the Carnegie collection than represents the true frequency of distribution. At any rate there is no evidence that tubal twins rupture earlier than single pregnancies, as Martin (1895) assumed; the available data, which may not be entirely trustworthy, indicate the contrary.

7. *Age of the embryo.* The average age of 46 normal single tubal embryos in the single series is 8.0 weeks. In the twin series the mean age of 37 monochorial specimens is 11.6 weeks. If it be assumed that the Carnegie collection contains disproportionately few large specimens, and if, for this reason, all fetuses over 14 weeks in age (i.e., 22, 24, 32, 40) be omitted from the twin series, the remaining 33 still average 9.4 weeks. Why this should be so is not evident unless, as already stated, the older single fetuses are not so diligently preserved.

8. *Fate of the embryo.* The fate of the tubal embryo is varied. A normal, growing ovum rapidly burrows into the wall of the tube and usually perforates it. If rupture occurs into the broad ligament, development may continue even to term. If, on the contrary, extrusion is into the peritoneal cavity, in most cases the embryo will die and disappear. Ova which do not become well implanted in the tube undergo early degeneration, usually without rupture. In many such dissolution is remarkably rapid, the embryo first disappearing and then more gradually the chorionic sac. To this group belong almost all small pregnant tubes, for had the embryos continued growing normally these specimens would have been much larger by the time the condition was recognized and operated upon. Hence one learns not to expect normal specimens in small tubes with histories of 6 or more weeks' advancement. On the contrary some fetuses and their membranes resist disintegration for long periods. Albertin (1903) described 3 months' tubal twins which had ceased growth a year before, yet appear to be well preserved. In Folet's (1896) case unequal twins with cords and a placenta had persisted 15 years uncalcified; one member of the pair was full term, the other at 3 months. Haydon's (1864) specimen was a successive pregnancy which contained a 2 months' embryo, dead 4 or 5 years; in the same category are the cases of Henriciuś and Kolster (1899) and Coe (1893) who recorded the preservation of fetal bones for 6 years and 9 or 12 years respectively. A most remarkable illustration is that of Varnier (1900) who found a full term lithopedion, cord, and placenta in the abdomen of a woman 75 years old who had carried them for 33 years.

The outcome of the twin pregnancies is recorded in 40 cases. Twenty-nine recovered; 10 died; one was found at autopsy. Contrary to the opinion of Hardouin (1919), who found records of only two fatalities, the novelty of the specimens appears to overbalance any reluctance in reporting unsuccessful operations.

9. *The maternal adnexa.* Mention may be made of some miscellaneous data, chiefly relating to the maternal adnexa in tubal twin specimens. In the single series the position of the tube, whether right or left, is noted in 52 cases. The right tube was involved 19 times, the left 33. The twin series yields information in 36 cases, of which 17 designate the right tube, 19 the left. Combining all 88 cases; 52, or 60 per cent, were on the left side, the remaining 36 on the right. There is no evident reason why this unbalanced ratio should exist although there are suggestive parallels among other animals. Thus in certain skates the left ovary alone functions while in birds the same condition holds, due to the degeneration of the right. Of the mammals the monotremes

have a larger left ovary and eggs have been recovered only in the corresponding tube. In young calves Willier (1921) found that two-thirds possessed a larger left ovary with more advanced follicles than the right. Corner (1921) has recently published tables from which it appears that in 139 sows, 616 corpora lutea were in the left ovaries and 504 in the right; in this animal the history of the corpus luteum is known exactly and they represent accurately the number of eggs discharged. For man, Simpson (1906) and others have held that the left side usually has the female type of gonad and hermaphroditic disturbances are generally on the right. On the contrary, Murray (1918) reports 75 observations which show the human corpus luteum 38 times in the right ovary, and 37 in the left.

Corpora lutea are mentioned in 8 individuals of the twin series, 5 times in the homolateral ovary and twice in the opposite ovary. Nine ovaries are recorded as pathological, 3 homolateral and 6 contralateral. Ten (or 11?) ovaries were removed, 6 (or 7?) on the same side and 4 opposite. In 9 cases the opposite tube was excised and the uterus twice. The removal of these adnexa is significant in view of accumulated statistics which show that of all women having ectopic pregnancy only about 33 per cent have a normal uterine gestation later, while about 15 per cent have a repeated ectopic pregnancy in the other tube.

The twin series furnishes 36 adequate menstrual histories. It is of great interest to learn that in 9 cases, or 25 per cent, the embryos are of such size as to indicate there had been one, and in a few cases more than one menstrual period after the pregnancy had begun.

10. *The symptoms of tubal twin pregnancy.* The symptoms are qualitatively identical with the classic picture of ordinary tubal gestation. Quantitatively the time of rupture seems on the average to be retarded—from the data available, at the end of the tenth week (see preceding page). Actually the condition has never yet been diagnosed before operation; in the older cases it might be done by X-ray.

11. *The cause of tubal pregnancy.* Possible predisposing or causative factors of tubal implantation are mentioned in only a few instances in the twin series; for example, two had suffered from puerperal fever, two with peritonitis and one oophoritis. However, Mall (1915) has shown satisfactorily that any change which delays the ovum in its progress will favor tubal pregnancy and that the commonest factor so operating is inflammation of the tube (see *the sterile period*).[1]

12. *The cause of tubal twinning.* The tendency to produce double ovum "twins," which really are not twins at all, is often hereditary. The present twin series offers one illustrative case (Saniter, 1905) in which both grandmother and sister had also borne twins.

Single ovum twinning, on the contrary, is not directly heritable but is the result of immediate environmental influence on the course of development. Thus, Child's (1907) monochorial specimen is from a mother of six children, the last twins 5 years before; here the data is meager and does not imply heredity but rather a common cause in both instances. Lucas-Championnière's (1903) case is one of single ovum twins after 10 years of sterility; there were no twins in either the father's or mother's family. In McCann's (1906) case the twins came 11 years after the last birth and were monochorial; the patient's mother had had fourteen children, but there was no family history of twins. Stockard (1921) has reduced the causal terms of single ovum twinning, and all non-hereditary malformations as well, to the common basis of properly timed developmental arrests. This principle may be applied to human twinning (Arey, 1923 b). The same conditions that induce or accompany tubal implantation also appear to favor twinning, for tubal twins are about fifteen times more common than the uterine ratio (Arey, 1922 b).

13. *Superfetation.* Although superfetation is doubtless exceedingly rare and most cases may be justly criticized as spurious, it is absurd to deny its contingency even if proof is difficult. Admitting the possibility of ovulation after pregnancy has begun, there can in any event be no argument against successive bilateral tubal twins or a tubal gestation combined with a later uterine pregnancy. When

[1] A more detailed exposition of the causes of tubal pregnancy and tubal twinning may be found in separate publications of the writer (1922 b; 1923 b).

there exist two unequal embryos with separate sacs, or unequal chorionic vesicles the larger of which contains an embryo and the other merely degenerating villi, or separate tubal enlargements containing villi only, it is necessary to consider them at best as doubtful twin specimens, e.g., Handley (1906); Fenger (1891); Johnson (1894); if the history is strongly corroborative they become probable, or presumptive cases, e.g., Saniter (1905), Schauta (1905), Ferroni (1903). On the contrary, markedly unequal fetuses may be satisfactorily accepted as twins under exceptional circumstances. An example is Folet's (1896) case in which a single chorionic sac contained a full term and a 3 months' fetus both connected to the same placenta. Another illustration is furnished by Rupin (1860) wherein a 6 months' fetus and the bones of a 4 months' fetus were found within a common sac; the history supports definitely the twin interpretation. On the contrary, the histories of certain other spurious cases point to the fusion or incorporation of an older by a younger specimen (Henricius and Kolster, 1899; Racoviceanu and Bogdanovici, 1904).

SUMMARY

Tubal pregnancy (single and twin) tends to occur in women who are older by four and one-half years (31.0 years) than the average age for motherhood (26.5 years). These women fall into two groups: (1) Three-fourths are already mothers (but without recent pregnancies) and nearly one-half are multipara; previous abortions are common. (2) One-fourth have been married a relatively long period without becoming pregnant. The sterile period since marriage or the last pregnancy averages nearly 6 years.

The best data available indicate that rupture occurs in 58 per cent of all cases of single tubal pregnancy. The greatest frequency of rupture, and hence peril to the mother, is in tubes with normal embryos (70 per cent rupture), less in those with pathological embryos (50 per cent rupture), and least in tubes which contain degenerating ova without embryos (40 per cent rupture).

Eighty per cent of the recorded specimens of monochorial tubal twins had ruptured, but this figure is surely too high, because unruptured specimens with degenerated embryos of necessity remain unrecognized. There is nothing to indicate that monochorial twins by their bulk alone induce more certain rupture.

The average time of rupture in single tubal pregnancy is at 7.7 weeks. The corresponding figure for tubal twin pregnancy is 10.9 weeks. It is probable that the unusual feature of twinning leads to a more representative collection of the older specimens than in single gestations; hence the later date in the twin group is not really significant.

The average age of normal, single, tubal embryos at the time of operation is 8.0 weeks. In the tubal series the mean age of the monochorial specimens is 11.6 weeks.

Tubal embryos that cease development may remain unresorbed for long periods. On the contrary most disappear rapidly, first the embryo, then its sac. For this reason tubes that are still small at the usual time of operation contain at best pathological embryos. It is only in small tubes with early histories that the most desirable young stages will eventually be found.

One-fourth of the tubal twin specimens have histories that indicate that at least one menstrual period occurred after pregnancy began.

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AUTOTRANSFUSION[1]

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MR. I. B., age, 51; occupation, farmer. The family history is negative. Patient is the father of three children. His wife has had no miscarriages. Patient had the usual diseases of childhood. In 1917 he had three chills in 24 hours. His physician diagnosed them as coming from the kidneys. In 1921, he had the influenza, which was followed by a vesicular eruption limited to the upper left half of the body. He denies venereal disease, his habits have been regular, and digestion has been good. He has had frequency of urination for the last 3 months.

Sixteen years ago patient was seized with an attack of bloody vomiting. Following this he noticed the appearance of a lump in the left side. Five years later he was seized with an attack of vomiting and, as he expressed it, passed blood and corruption both ways. The tumor became immediately smaller but in a short while took on a rapid growth and attained two-thirds of its present size. He has had a similar attack about once each year, followed by pain and tenderness over the tumor and confining him to his bed for several days. In the intervals he has done hard manual labor. The tumor caused him little inconvenience except when he leaned over. For the last 2 years he has been gradually growing weaker, and for the past 2 months he has been unable to work. The tumor has increased noticeably in size and he has swelling of the feet and ankles for the first time. He is 40 pounds underweight.

The interesting points on physical examination were the protuberant abdomen, marked anæmia, emaciation and expression of anxiety reminding one of the facies ovarica. There were no enlarged glands. The heart was pushed up. A blowing murmur, systolic in character, was heard over the whole præcordia. The mass in the abdomen was outlined as follows: Level with nipple—left axillary line passes downward under xiphoid process, crosses the median line to a point 2¾ inches to the right and on a level with umbilicus, then it passes downward and to left crossing median line 2 inches below navel and goes across to crest of left ilium and upward, filling in the flank and back to the point where it started. The mass is hard and a distinct notch can easily be made out. It moves up and down with respiration and can be pushed over to right side 1½ inches from its normal position and is dull to percussion. Urine is negative except for a few hyaline and granular casts. The blood shows the usual picture of severe secondary anæmia, hæmoglobin of 35 per cent. Coagulation-time, 3 minutes. Wassermann, negative. Malaria, negative.

X-ray shows large mass in upper left abdomen extending downward and to right. Kidney shadow is normal. The blood pressure is 128—88. Pre-operative diagnosis: splenic anæmia.

Patient entered hospital August 18, 1922, and 750 cubic centimeters of citrated blood was given to patient with rise in the hæmoglobin to 55 and a corresponding rise of the other elements. Two days after the transfusion the patient was taken to the operating room and the abdomen opened along the whole length of the left rectus muscle. There was a small amount of free fluid in the abdomen, and the spleen was found to be densely adherent to all the surrounding viscera as well as to the parietes of the left side and diaphragm. These adhesions were very vascular. The spleen was first detached from the diaphragm and the sides of the left abdominal wall, and hot packs were immediately placed in these locations. The other adhesions were then carefully tied and cut, the pedicle was doubly ligated and the spleen removed. The operation was not only difficult but bloody. The patient's pulse was 72 at the beginning of the operation; at the time the spleen was removed it was 140. The large amount of blood that was lost in the abdomen during the operation was recovered by means of expressing the contents of the abdominal packs into a glass receptacle. A little over 800 cubic centmeters, of blood was recovered, and after this was citrated and strained it was injected into a vein at the elbow. The management of the blood and the transfusion was carried out by Dr. R. C. Derivaux, and by the time I had covered over the raw surfaces and closed the abdomen he had almost completed the transfusion. At the time the transfusion was started the pulse was 140 and barely perceptible; at its completion, pulse 102, strong and patient's color good. There was no reaction following the transfusion. Operative recovery was unusually smooth and at the end of 2 weeks he was able to leave the hospital and return to his home. The spleen weighed 7½ pounds and its measurements were 14 by 8 by 4 inches. The postoperative diagnosis was splenic anæmia, which was confirmed by the pathological report.

The full details of this case have been reported for the reason that it impressed me as an ideal case for autotransfusion. I have used this procedure in 3 other cases successfully: 2 of ruptured tubal pregnancy, the third a nephrectomy. I suggested autotransfusion in a discussion of a paper on "Ovarian Apoplexy" at the Chattanooga meeting of the Tennessee State Medical Society, in 1919. At that time I was under

[1] Read before Southern Surgical Association, Memphis, Tennessee, December 12, 1922.

the delusion that I was bringing out something new, but a search of the literature showed me that the Germans had been using this procedure since 1914. The abstracting and search of the literature was carried out for me by the Research Department of the American College of Surgeons. Numerous articles of unusual merit and scientific interest are included.

LITERATURE

Autotransfusion was first used by J. Thies in 1914. Since then 164 cases have been reported in European literature covered in this review. Following operation fourteen deaths were reported: one resulted from a technical error, one from hæmoglobinuria, the remaining 12 were from postoperative complications or concurrent injuries. The method has been most frequently used in Germany. Only 4 of the 164 cases were reported from outside of that country. The type of case was most frequently ectopic gestation, rupture of the spleen or liver, and hæmothorax. In only 6 cases was there a postoperative reaction. In cases of large hæmorrhage in an infected field, A. Shafer has collected the blood and used it as a rectal enema with very favorable results. It has also been given subcutaneously and intramuscularly. Zapelloni and Biser have used gauze to remove the blood. The other authors have employed vessels of various description. It has been frequently commented on by many authors that blood in the pleura or peritoneum coagulates very slowly and may be used after a considerable time. Some authors seem to think that re-infusion has some hæmatopoietic action. The operation has been used by twenty-eight European surgeons. Only one (Opitz) advises against it.

Von Arnim (1) reports that the University of Kiel has employed re-infusion in 12 cases of extra-uterine pregnancy out of a series of 135 treated since 1916. Saline solution was used with the blood in the proportion of 2 to 3. Re-infused patients recovered more rapidly than many patients in whom bleeding was not profuse. Of the 12 cases, 1 died because of an obvious blunder in technique and diagnosis.

Blechschmidt (2) reports 4 cases of ruptured tubal pregnancy with no mortality. An addendum to the thesis states that in the meantime 2 cases had been treated at the Zwickau Hospital following rupture of the spleen in which autotransfusion had been combined with extirpation. In 3 cases the loss of blood was more than 3 per cent of the weight of the body, so that a saline solution probably would not have sufficed. A review of the material shows that the re-infusion of even small amounts of the patient's own blood is beneficial.

Bumm (3) reports 13 cases of auto-reinfusion in extra-uterine pregnancy with 1 death (patient was practically moribund at the time of operation). In 2 cases rigor and fever followed the infusion immediately. Bumm is of the opinion that the patient's own blood is superior to that of any donor.

Burchhardt and Landois (4 and 5) report one case in which death occurred as a result of a shrapnel wound of the spinal cord. The patient was temporarily much improved by re-infusion.

Burchhardt (5) states that Thies originated the method of auto-reinfusion that Lichtenstein used 1 year later. Thies was unable to report a large number of cases because of his work in the field.

Doederlein (6) reports 5 cases of auto-infusion with 1 death due to septicæmia which had no relation to the autotransfusion. He says that experiences show that autotransfusion is a harmless and life-saving procedure.

Eberle (7) reports 8 cases of autotransfusion in ruptured tubal pregnancy with 1 death. The immediate effect of transfusion in the fatal case was good. In 4 traumatic cases all died. All were in a serious condition when transfusion was done. Good effects followed the infusion in 2 cases. The author in conclusion says the problem of blood transfusion is by no means completely solved. Much is theoretical. Blood physiology, experimental surgery, and hospital practice must progress considerably before a final judgment upon the procedure can be given.

Elmendorf (8) reports an interesting case of a soldier, age 25, who was injured in the right thorax by an infantry shot. He collapsed immediately and was carried three hundred paces to the temporary station. After watching the case for 1 hour, an ordinary infusion needle was inserted between the fifth and sixth ribs in the mid-axillary line. By this means 100 cubic centimeters of blood was withdrawn three times in the course of 15 minutes and immediately injected into the arm. The blood was filtered through a compress and no coagulation was noted. Progressive improvement followed. On the eighth day the soldier was removed farther back from the front and on the fourteenth day was transported to a base hospital.

Fieber (9) reports the successful use of auto-reinfusion in a case of rupture in the spleen from a grenade wound.

Henschen (10 and 11) makes a complete review of the literature but adds no case reports. He favors re-infusion to facilitate recovery, even in cases involving only moderate hæmorrhage.

Kreuter (12 and 13) reports the successful use of re-infusion in a case of rupture of the liver. In another case of rupture of the liver, good results were

obtained from transfusion but the patient later died from concurrent injury.

Kulenkampff (14) reports the use of auto-transfusion in 9 cases of ectopic pregnancy and 2 cases of rupture of the spleen.

Landgraf (15) suggests that auto-transfusion be practiced following loss of blood during operations but he had not tried out the suggestion.

Laewen (16) used the method in 3 cases of injury to the liver from war wounds with immediate good results, but the patients later died from concurrent injuries.

Lichtenstein (17, 18 and 19) reports the use of auto-transfusion in 39 cases. There were 25 cases of ruptured ectopic pregnancy with a successful result in all. Six cases were war injuries treated in the field and unfavorable results were reported only in such cases. He brings out a point which is corroborated by a number of others that rather long intervals may elapse before unfitness of the blood for re-infusion need be feared.

Loehnberg (20) reports successful use of the method in 14 cases. The quantity of blood injected varied from 500 to 1150 cubic centimeters. It was maintained at body temperature after defibrination by stirring with a glass rod and was injected without being thinned. He is convinced that no other method can produce equal results.

Opitz (21) reports one case of somnolence, icterus and restlessness, not alarming, following auto-transfusion. He advises against autotransfusion and will return to his old procedure of leaving the blood in the abdominal cavity whence it is absorbed rapidly.

Ostwald (22) reports one successful case of re-infusion following a ruptured ectopic pregnancy. He is of the opinion that in addition to neutralizing the low blood pressure and increasing the amount of fluid in the veins, re-infusion returns to the blood a number of normally active erythrocytes and a serum adapted to the particular organism with reference to protective substances and secretions.

Peiser (23) reports the successful use of auto-reinfusion in rupture of the spleen.

Ranft (24) also reports a successful case in rupture of the spleen from a grenade fragment.

Rietz (25) reports some interesting experimental work on animals.

Roedelius (26 and 27) reports 12 cases of auto-transfusion used in ruptured tubal pregnancy. He states, however, that he believes only 1 of the 12 cases re-infused would have died without this aid.

Schaefer (28, 29, and 30) reports 4 cases of auto-transfusion following obstetrical accidents. In two of these cases blood was expressed from the placenta. In one case, on account of the blood being contaminated, he used it as a rectal infusion.

Thies (31) was the first surgeon to advocate and use autotransfusion. Three cases of extra-uterine pregnancy are reported. All three patients who had been pulseless recovered and were dismissed 7 days after the operation. Before this method was employed the blood in several other cases had been examined bacteriologically. It was always free from bacteria. Microscopically all erythrocytes were intact. No coagulation had occurred. The method is recommended for cases that are pulseless and where the hæmorrhage has occurred recently.

Toepler (32) reports 24 cases of re-infusion in ruptured extra-uterine pregnancy. He quotes Schweitzer who reports one death from hæmoglobinuria.

Wederhake (33) strongly recommends auto-transfusion in gunshot injuries to the lungs. With a hæmothorax the blood was removed by means of puncture, filtered through a sterile cotton wadding, and injected intravenously. It was always possible to dispense with the use of sodium citrate and with defibrination. Experience has shown that the blood of a hæmothorax coagulates with difficulty.

Zapelloni (34) reports a successful case of re-infusion in ruptured ectopic pregnancy.

Two cases are reported in English literature, one by Dr. Ogilvie of Guy's Hospital and one by Sampson of the General Hospital, Birmingham.

The American literature up to the present time shows very little on this subject. The author personally knows of a number of cases, however, that are to be reported soon.

Dr. Francis C. Grant (35) reports a very interesting case from the service of Dr. C. H. Frazier of the University Hospital, Philadelphia. A suboccipital exploration was determined on. It had been their routine practice of late to transfuse post-operatively all cases upon whom a suboccipital exploration had been performed. The patient was large, stout, and plethoric. Five hundred cubic centimeters of blood was withdrawn, kept in 2 per cent sodium citrate solution, in the refrigerator. Twenty-four hours after the withdrawal of the blood, the operation was carried out and the patient's citrated blood was injected into a vein of the arm without reaction. The postoperative course was favorable. Grant suggests in conclusion that although the plethora and high blood pressure seemed special indications in this case, autotransfusion might be considered in other conditions.

Dr. Murray B. Davis (36) reports a case of auto-transfusion for gunshot wound of the spleen. The transfusion served an excellent purpose, but unfortunately the patient developed a bronchial pneumonia and died on the ninth day.

Levine and Segall (37) have a very interesting article on "Posttransfusion Reactions." They bring out the point that a long operation in which ether is used as the anæsthetic alters the patient's serum as regards its hæmoagglutinin properties. This change is not a permanent one but disappears during the first 24 hours after operation, i.e., just before the time when the patient has recovered from the effects of the ether anæsthesia. They conclude

as follows: First, the compatibility of the recipient's and donor's blood must be determined prior to each and every transfusion; second, no transfusion must be done during or within 24 hours after prolonged ether anæsthesia, even when the donor has been found suitable previous to the beginning of the anæsthesia.

If these conclusions are correct, and I believe that they are, it makes autotransfusion a most valuable procedure in certain cases.

CONCLUSIONS

Autotransfusion is a safe procedure, although in a limited number of cases reactions will occur.

Sodium citrate is not essential. Normal salt solution will make an admirable substitute and if neither of these is at hand, the pure blood may be re-injected.

Extra-uterine pregnancy will offer the largest field of usefulness for this procedure, but in wounds of the spleen, liver, wounds of the lung producing a hæmothorax, and in operations where a large amount of blood is unavoidably lost, it will not only save life but will hasten postoperative recovery.

Contaminated blood should not be thrown away, but should be given as a rectal drip.

Autotransfusion may occasionally be used to advantage in certain obstetrical complications, such as placenta prævia, rupture of the uterus, and cæsarean section.

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BISMUTH PASTE TUMORS[1]

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SINCE bismuth paste has been used so extensively in this clinic for so many years in the treatment and diagnosis of suppurating conditions about the head and body, and as we have within a short period of time observed a series of four cases which presented themselves with obscure findings following its use, it was deemed advisable to study more carefully the probable cause and character of the pathology of such a tumor formation.

Inasmuch as we find that there is an ever-increasing use of bismuth paste and modified pastes and preparations of bismuth, it is rather interesting to note that there may be a tendency toward an inflammatory growth. The use of bismuth paste, therapeutically and diagnostically,—especially the latter—is considered by many to be of utmost value and more so since the advent of the X-ray. As a diagnostic agent to determine the course of sinuses, to follow them throughout their devious paths and localize definitely the nidus of infection, the injection of bismuth paste and its interpretation by the X-ray is of greatest value. Were there no therapeutic indication of efficacy in its use, the information it reveals about the character and extent of the exploratory procedure required, would be enough in its favor. However, we know of its many advantages, have seen good results from its use and so have many others who go down on record in the literature as having obtained splendid results. There are today, even more indications and values for employing this material. Therefore, we would not have it appear that tumor formation is a frequent occurrence, but report it on the basis of its rarity and perhaps add a few significant points to be remembered and kept in mind in its use.

Bismuth paste has been in use for more than 15 years, having first been presented by Dr. Emil G. Beck and his brothers, in 1906. It has been used continuously since that time by themselves and others, both diagnostically and therapeutically. It is prepared in varying strengths and mixtures, depending upon the indication, but it is not the purpose of this paper to give any detailed report dealing with its preparation other than it concerns points of argument as they arise. We shall, however, refer to the abundant literature on the subject.

Because of the close similarity between paraffinomata, camphorated oil tumors, vaselinomata, and the tumors caused by bismuth paste, common points of interest will be discussed. While these tumors may not be the same, it is interesting to note that the bismuth paste may, and does, more or less involve them all, since it contains not only bismuth subnitrate but also vaseline and paraffin in small amounts. The paste employed in our work contains 10 per cent bismuth subnitrate in vaseline, to which is frequently added small quantities of paraffin and white wax, all of which are mixed together until a homogeneous mixture results. There are three other bismuth paste mixtures which are used, containing larger amounts of the subnitrate of bismuth, all of which must be prepared under the most aseptic precautions. The method of introduction of the paste is by the use of metal or glass syringes, many types of which have been devised to fit the individual indication. The paste is introduced in semiliquid form into the sinuses with moderate amount of force. These injections are repeated, in some instances every day or every other day, depending entirely upon the existing pathology and the response to previous injections.

It is a well-known fact that the injection of paraffin has a tendency to cause the formation of inflammatory growths with the possibility of becoming malignant, and it was on this basis that its use, especially in rhinocosmetic fields, was discouraged. When Gersuny, in 1900, published his article "Subcutane Prothese," the paraffin idea was greeted as a revelation, and his own cases opened up many channels for a possible usefulness of this material as was mentioned and suggested by him. The basis of his experiments was as follows: If melted vaseline is injected into the soft tissues of the human body, the embedded

[1] Studies, reports, and observations from the clinic of Drs. Joseph C. Beck, Harry L. Pollock, and Francis L. Lederer, Chicago. Presented before the Chicago Pathological Society, November 13, 1922.

Figs. 1, 2, 3 and 4. Showing bismuth paste mass in frontal sinus following a radical frontal sinus operation. (Case 1.)

mass, after hardening, apparently remains unchanged and stays where it has been deposited. Then followed Corning (1891) who suggested the introduction of solidifying oils into tissues in order to bring about the occlusion of blood vessels. M. Balzer (1886) demonstrated conclusively that vaseline is not absorbed in tissues but persists there in the state of foreign droplets and that this results whether the vaseline is introduced in all pathological processes but especially in tuberculous conditions.

It is commonly agreed that the introduction of such foreign substances as paraffin, vaseline, camphorated oil may produce a traumatic inflammatory reaction which is brought about by tearing, stretching, or forcing apart various tissue fibers, leading eventually to the formation of connective tissue, resulting, as in the case of any foreign body, in an attempted encapsulation of the injected material, assuming, of course, that we are dealing with a sterile agent. The small globuli are broken off from the material by muscle contraction, then travel and stimulate connective-tissue and cell proliferation of the adjoining tissue in their paths. They thus finally grow together like a sponge and are formed into a meshwork.

There are, of course, various factors to be considered in drawing any conclusions as to why such a reaction occurs. It is highly probable that the melting points of the mixtures may be factors. Eckstein says, and by well-carried-out experiments has proved, that mixtures up to 110° F. (this figure probably being the limit) even if injected in semi-solid state, do not retain their pasty consistency in the body. If vaseline, up to a melting point of 105° F., is cooled down in the syringe to a consistency of semi-solid thread, which it attains at a temperature below that of the body, and then is injected, it naturally melts again into a fluid state as soon as it is deposited into tissues having a higher temperature. Even a mixture having a melting point up to 110° F., is at 99° F. just as good fluid. As proof of this, may be cited many cases where vaseline, when introduced into fossæ and tissues, could be recovered many years later, remaining in a perfectly fluid state. Eckstein concluded from his experiments that, different from the vaseline or paraffin of a very low melting point, which, according to Gersuny and others, is permeated by the proliferating connective tissue and subdivided into meshes containing single, shining globuli of small proportions, perhaps is apt to be absorbed: whereas paraffin of a high melting point will never yield to absorption. This, however, is a much disputed point, and many are affirmed in the belief that the melting points are not important factors.

Hertel, in the work of replacing orbital defects, did excellent work in many series of cases and his deductions are quite interesting. He believes that differing results lie with the differing distribution of the paraffin with regard to the tissues and refers to the work of Leber, who proved that the irritative effects of foreign bodies upon tissues are augmented if they are finely divided, and that the larger

the surface they come in contact with, the more intensive the irritative effects. Hertel also emphasizes that there may exist still another important factor and that is that all preparations of vaseline, paraffin, etc., may not have the same chemical composition, and was of the opinion that the new-growth of connective tissue ultimately leads to the reabsorption of the material, and the harder the paraffin, the more protracted the process.

However, it is a mooted question as to what ultimately happens to the bismuth vaseline preparation. Dr. J. C. Beck introduced the paste into various sinuses, such as the frontals, sphenoids, and antrum, and studied radiographically the length of time the bismuth remains in these cavities, but came to no definite conclusions. Dr. E. G. Beck contends that most of it is found in the dressings within 24 hours after injection; in other sinuses, which are deep and tortuous, the paste will remain in them for days and even weeks, and says that frequently it will heal in and become encapsulated and gradually be absorbed through the process of organization of the mass by connective tissue. The latter author also checked up the reaction of living tissues to bismuth paste, and this same process was found to go on. His microscopical studies showed the border of the bismuth crystals infiltrated with round cells and the spaces between the crystals packed with young connective tissue cells. The border between the bismuth mass and the muscle tissue removed, consisted of several strata of elongated connective tissue cells forming concentric layers and in some places, merging into fibrous bands encircling the bismuth plug. There was also seen a large number of irregularly arranged, shorter and longer, spindle shaped cells, which in places invaded the interstices of the adjacent muscular tissue. Whatever the histological findings might have been, Beck thought that radiographic evidence was proof enough that bismuth was absorbed and gave as example lung abscess cavities, which were shown in various stages as time progressed and the lung expanded, with a diminution of their radio-obstructive contents. Just what happens to this material is not the object of this paper because Beck and others long ago considered this phase of the subject in connection with bismuth poisoning and found that bismuth, when absorbed, may be found in the cells of the liver, spleen, muscles, and intestines.

Fig. 5. Roentgenogram showing bismuth mass in frontal sinus. (Case 1.)

This paper deals mainly with the local manifestations resulting from the use of these materials. Experience with vaseline and various other mineral oil preparations has demonstrated time and time again their resistance to absorption. Moschiewitz, Gersuny's assistant, was detailed to study the question thoroughly and one of his most important conclusions was that if injected vaseline is left undisturbed for a time and protected from muscular contraction or pressure from without, it becomes firmly encapsulated and should be well able to withstand absorption. It is in this connection that camphor oil tumors deserve mention and especially the work of M. Letule in collaboration with M. Alglave on pseudo-tumors provoked by the injection of medicated vaseline into the tissues. They report many cases of such tumors which were studied clinically and histologically in vary-

Figs. 6 to 9. Tumor mass in mid-line of neck and mass removed at operation. (Case 2.)

ing stages, as their cases were of long and short duration. One case was of 16 years' standing in a woman who had received several injections of camphor in oil into the breasts. There resulted ten or twelve masses varying in size up to that of a walnut and seeming in some way or other to be connected with one another. They were located just under the skin and seemed to be adherent to it, being smooth and in some places appeared so congested as to resemble early abscess formation. Having had experience with such tumors they recognized them immediately. The patient in subsequent child-births could not nurse her infants because of interference by these masses with lactation. The tumors were only slightly painful and this did not occur until 11 years after the initial injection. Operation was advised but was not as cosmetic as originally planned due to the ramification of the masses into the pectoral muscle and adjacent tissues. These masses were fibrous, especially toward the center of the original injection and softened out toward the periphery. They cut with a firm resistance. Grossly they resembled masses of fibrous and adipose tissue. The authors then concluded that camphorated oil should be avoided because of its slow absorption but progressive and uninterrupted tendency toward tumor formation.

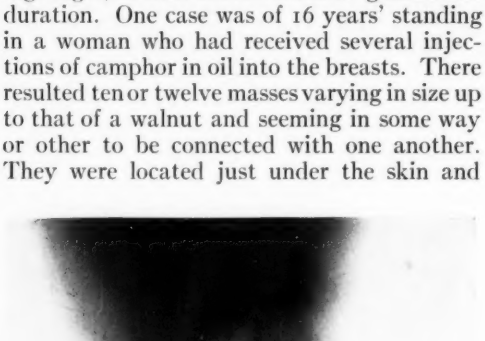

Fig. 10. Roentgenogram showing bismuth mass in neck. (Case 2.)

CASE 1. A. S., male, age 25. In November, 1921, patient had a mild influenza which became complicated by a pansinusitis and accompanied by meningeal symptoms. He went along for 2 weeks with marked toxic symptoms, when at this time a fluctuating mass was found to be necrotic in an area about the size of a dollar. He was referred to us on December 1, 1922, still complaining of frontal pain. The X-ray at this time revealed a bone necrosis in the frontal region with the posterior table apparently intact. Operation was advised and under synergistic analgesia, a radical frontal sinus exploration was done. The periosteum over the frontalis was found greatly thickened, being about one-fourth inch thick. Granulations were forming on its posterior surface. The interior table over

Figs. 11 to 14. Healing after removal with tendency toward keloid formation; after radium application to keloid and final result.

both sinuses was found to be necrotic and a horse-shoe-shaped sequestra was removed. Both sinuses were quite large and were filled with granulations and thick, desicated pus. The mucous membrane lining of the sinus had undergone polypoid degeneration and polyps were found blocking the nasofrontal ducts. Drainage was established into the nose and the wound closed by interrupted sutures. He was redressed daily; temperature remained normal and on the fourth day, a colloidion dressing was applied. Except for swelling of both upper lids patient made an uneventful recovery. On December 31, 1921, bismuth paste (10 per cent) was injected into both frontal sinuses and patient was allowed to go to his home. On May 28 patient returned having had an uninterrupted course, except for a swelling over the frontal sinus which did not bother him and was not tender. The nasal examination was negative; externally was seen a small tumor-like mass about the size of a half dollar. No fluctuation nor tenderness was elicited and the tumor was hard and not very well defined, being infiltrated into skin and adjacent tissue. X-ray examination revealed a bismuth mass in frontal sinus.

Case 2. C. R., male, age 15, Italian. About 2 weeks before, while at work patient noticed neck was getting stiff. He went home and went to bed complaining of a general malaise. The next morning when he awoke he noticed his neck was badly swollen and slightly tender. He went to his family physician who tried palliative measures, but the swelling and fluctuation became so severe that he incised the left side of the neck in two places above the sternocleidomastoid muscle. About this time patient was referred to us. He was quite toxic and had a leucocytosis of 16,000; the blood culture was returned negative and the pus showed a pure culture of staphylococcus aureus. Examination of the nose revealed an extreme amount of crusting and atrophy; teeth, showed poor hygiene but were in fair condition; tonsils definitely pathological and injected, pus being easily expressed from them. The areas in the neck were still draining but the patient's condition was very poor. Palliative and general tone methods were carried out. About 2 weeks later after the acute symptoms had subsided bismuth paste (10 per cent mixture) was injected into the draining sinuses. It was noticed at this time that these sinuses communicated with an area suprasternally, but this was thought only to be a communicating sinus. He was injected with bismuth on two successive days and then began to get a series of X-ray treatments to the side of his neck. The patient was discharged with sinuses healed 3 weeks from the time he was referred to us. About 1 month later patient returned with an enlargement in the mid-line of his neck just above the sternum. It was hard, very slightly tender and seemed to be infiltrating the skin and adjacent tissues for quite an area around it. It was not well defined. X-ray revealed the masses to be made up of bismuth. Patient was advised to do nothing. Then on July 19, under synergistic analgesia the tumor was excised. The mass was found to be adherent to the skin and to the substance of the sternohyoid and sternothyroid muscles. When removed it measured 2 inches in its greatest width and 3½ inches in length. It had a very hard, almost cartilaginous feel and cut with the resistance of dense, fibrous tissue. The cut surface disclosed innumerable pockets of varying shapes and sizes, the largest being about one-fourth inch in diameter, which were surrounded by dense, fibrous tissues. These pockets contained a thick, creamy, yellowish substance. Culture of this material and that taken from other places showed no growth after 48 hours. The smear revealed no organism but many crystal-like bodies. This wound healed uneventfully. About one month later there was found a very dense infiltration along the same place as where the bismuth mass was located. This had neither the consistency nor appearance of the former mass but was keloid in character. On this basis radium 103½ milligrams for 3 hours (310 milligram hours) was placed on the area. There

was only a slight local reaction following this radium application and the keloid disappeared. X-rays taken since still show small bismuth plugs which could not very well be removed at operation but are evidently deeply seated.

CASE 3. Sus., male, age 14. This case is in practically all respects similar to Case 2 so that repetition will not be necessary except to say that in this instance the mass formed at the site of injection on the right side of the neck. The mass was markedly adherent to the skin, not tender and had been present for 3 months. It was also excised and findings were of similar nature. It is interesting to note that this boy's brother had some such similar swelling following bismuth injection, but there is no confirmation of this other than clinically.

CASE 4. Mrs. J. B., complained of tearing and pus discharge in left eye for past year. After probing the lacrimal duct it was found to be stenotic. Patient was advised to have operation and so under synergistic analgesia the usual incision was made and the lacrimal duct was exposed. The canaliculus had previously been injected with a 10 per cent mixture of bismuth paste and found to be blocked about the region where it opens into the sac. The duct was then opened and the bismuth was found under tension. A small window was made into the sac and a passage made through the natural opening into the nose. This opening was enlarged by means of an electric burr and a catheter introduced into the groove and passing down into the nose just below the anterior end of the middle turbinate. The periosteum was sutured over the end of the tube which was brought up into the canaliculus. The external wound was then closed completely. The catheter was allowed to remain in for 4 days. Almost 3 weeks later the duct was injected with bismuth paste and was found to be patent, the paste coming out through the nose. Symptoms which she had formerly subsided for a time only to re-occur again when the duct closed. About one month later at the site of the old incision there formed a hard infiltrating mass which was not tender and not easily movable. This was thought to be due to the bismuth, and X-ray confirmed the diagnosis. Operation was advised and so under synergistic analgesia the old scar was resected. It was found to be infiltrated by bismuth as was much of the adjacent tissue and that below it, including the anterior wall of the sac, therefore necessitating removal of the sac in small pieces. Bismuth paste was easily expressed from the meshes of this tissue. The opening into the nose was enlarged, the wound packed from within the nose, and the external wound closed completely. Healing was ideal. While the patient has still some tearing there is no more pus and no scarring resulted.

HISTOPATHOLOGY

The microscopic sections of these tumor masses show a recent, not very vascular, connective tissue in different stages of development. This connective tissue is of varying age, some dense tissue, hyaline in character, and some looser, consisting largely of fibroblasts and oval cells. Blood vessels are but few in number and show nothing particularly characteristic. There are a great many spaces of different sizes up to a centimeter or more in diameter, irregularly distributed throughout the tissue, and in some areas they are so numerous as to give a honeycombed appearance. Most of the spaces appear empty, others contain bismuth granules or masses. In shape, the majority of the spaces are round or oval, the others being more or less irregular. The borders of some of the larger and irregularly shaped and slit-like spaces contain dense masses of bismuth granules between and within the young connective-tissue cells, while the smaller spaces, especially the round and oval, may be lined with a rather narrow rim of multinucleated cytoplasmic bands, resembling syncytium. Between the spaces, in the more cellular parts of the tissue, are larger and smaller multinucleated giant cells of the foreign body type, in some of which, as well as in the adjacent smaller cells may be fine bismuth granules.

The giant cells are most numerous in the region of the bismuth masses. Some are small, containing 3 to 5 oval nuclei irregularly arranged, others are larger with 10 or more nuclei. Occasionally a giant cell presents a small bismuth mass with its cytoplasm. Many of the spindle-shaped cells or fibroblasts, reveal fine and coarse bismuth granules within their cytoplasm. Some of these phagocytic cells are more oval in shape and may possibly be endothelial in origin.

A few scattered areas of round-cell infiltration occur among the hyperplastic connective tissue. The cells are chiefly small lymphocytes together with a moderate number of plasma cells.

The appearance of the tissue in general is that of a granuloma, due to the irritation of a foreign body with the resulting connective-tissue proliferation and giant-cell formation.

GENERAL CLINICAL PICTURE

Aside from the variance in time or period of activity, our series shows four patients who

Figs. 15 to 18. (Cases 3 and 4.) Patient with bismuth paste tumor in lacrimal sac and result after removal. Mass removed from neck.

developed bismuth paste tumors in different parts of the body. It is not a question of the extreme rarity of these tumors in cases where bismuth paste has been used, and these are many, but the fact is that they have occurred and have presented some interesting clinical features. All had practically these features in common following the injection of bismuth paste for a previous illness: tumor masses appeared within a range of 1 to 6 months; they have concrete-like infiltrations and vary in size depending on the site, the amount of material introduced and the amount of individual reaction. They are not well defined nor rounded in outline but are irregular and branch-like, there being bead-like infiltrates and ramifications in varying directions, appearing to follow out definite channels, perhaps the lymphatics. This sort of distribution is not to be wondered at when we consider that the paste is introduced with some degree of force and thereby is deposited between the connective tissue and lymph spaces, remaining there as an inert foreign body. The early discomfort is usually very slight and the tumors may not be painful or tender. Locally the skin may show some evidence of an inflammatory process, especially when of long duration, by assuming various hues of congestion. In the mass itself the localized pressure which the foreign body necessarily exerts stimulates, at least temporarily, a low-grade inflammatory process with subsequent gradual production of new connective and fibrous tissue, encapsulating the various particles. In two of the cases there was a tendency toward a breaking-down process with abscess formation. These four cases all presented conditions of chronic inflammation, superimposed on acute exacerbations and these therefore present an interesting anology in this respect.

Diagnostically, each one of these cases presented a very interesting problem in differentiating them from other neoplasms which may occur in these various regions. The bismuth mass in the frontal sinus is extremely interesting because this condition must be considered in the differential diagnosis of a very interesting group of tumors, which are seen radiographically in this region. The same holds true for the other cases, and adds the X-ray as a possible point in differentiating tumors about these parts, when there is a history of the use of bismuth paste.

Therapeutically it may be said that there is only one procedure of choice in dealing with these growths, and that is complete extirpation, at least as much of the tumor mass being removed as possible, without too great a mutilating effect. Palliative treatment in the way of hot applications, etc., seem to have a tendency to produce a breaking down of the tumor and therefore is advisable.

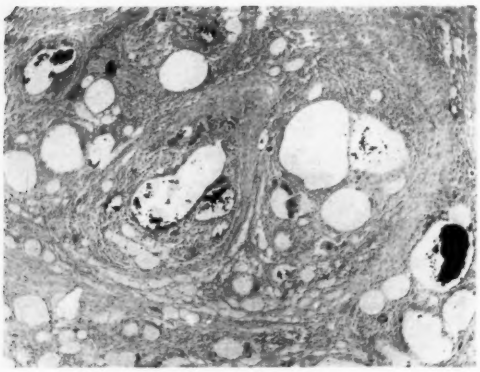

Fig. 19. Low power photomicrograph showing a recent, not very vascular, connective-tissue tumor, containing many spaces of different shapes and sizes irregularly arranged containing bismuth masses and granules.

If total extirpation leads to a tendency toward keloid formation and further infiltration of the tissues, radium applied locally to these definite areas seems to be of great benefit.

What then is the cause of these tumor activities? Vaseline injection alone and various mineral oil preparations have been condemned as dangerous, and warning given to avoid them because of their tendency to produce inflammatory tumors. It is certain that there may be something to this statement and that bismuth paste with its vaseline content is no exception to the rule; but that here too precautions must be exercised in its use. Bismuth subnitrate in itself has been shown not to cause any inflammatory growth, so that it is highly probable that even the reaction obtained in normal healthy tissues by experimentation is one that is due entirely to the presence of the vaseline in the mixture. One may say that as long as the compensatory circulation is present in or about these encapsulated masses that are known to occur, no trouble results; but that after a period of time there is a circulatory unbalance and venous stasis ensues, with the clinical pictures of varying degrees of inflammatory reaction, congestion, all depending perhaps on the amount of pressure exerted by the presence of these fibromata with the encapsulated paste.

As to what accounts for this sudden discovery of a bismuth paste tumor after observation of thousands of cases and without ever having seen any similar reaction, it is difficult to say. However, such inflammatory processes had never presented themselves as clinical cases for differential diagnosis, and therefore, it is highly probable that many similar cases have or do exist without our knowledge. Had not these patients come with such gross external deformities, all being very superficial tumors, they would possibly not have come to our notice. After the use of the bismuth preparation in many somewhat similar cases, it became problematical as to just why these cases in particular should have formed inflammatory growths. It is our opinion just as camphorated oil tumors form by subcutaneous injections, so do bismuth paste tumors form when they come in contact with overlying skin. Other factors which may play a rôle as we see it, are those of chronic infections, which seem to make the tissues more prone for further inflammatory irritations by the foreign substance introduced. We would, therefore, venture our opinion that when the material is introduced into bony wall cavities, taking for granted that there is no outlet, this substance is held inert in this cavity such as the sinus, and while it may infiltrate into the mucous membrane lining, it cannot go any farther because of the obstruction by the bony wall. With this, therefore, in mind it is not difficult to understand that in a case of the frontal sinus tumor which we report, it could have been possible because the entire frontal plate of the sinus had been taken away through the disease and the operative procedure. The principle of the formation of the other tumor masses is the same as that which has been discussed throughout the course of this paper.

It is really difficult to say just what future procedures should consist of in preventing such difficulties. We would not be so drastic as to say that the use of the substance should be discontinued because of the sudden appearance of these few cases. However, it must be kept in mind that there are possibilities through misuse of the preparation or not the proper understanding of its action, as a factor

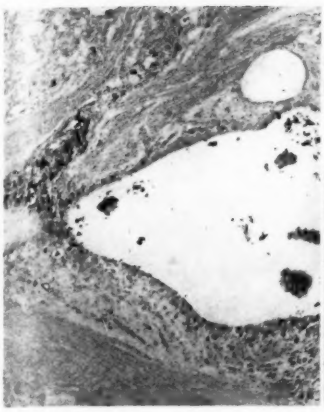

Fig. 20.

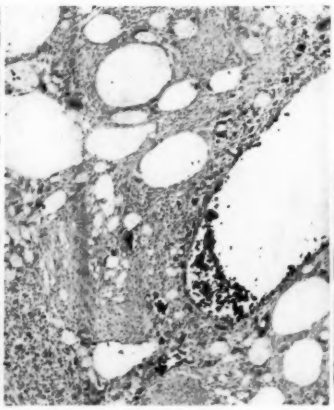

Fig. 21.

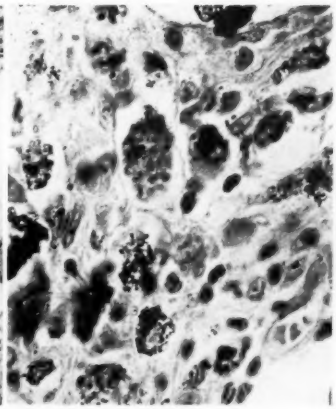

Fig. 22.

Fig. 20. Low power photomicrograph showing that the borders of these spaces contain dense masses of bismuth granules between and within the young connective-tissue cells. The smaller and more oval spaces are lined with a rather narrow rim of multinucleated cytoplasmic bands resembling syncytium.

Fig. 21. Low power photomicrograph showing that there are a few scattered areas of round-cell infiltration among the hyperplastic connective tissue. The cells are chiefly small lymphocytes together with a moderate number of plasma cells.

Fig. 22. High power (×7000) photomicrograph showing the foreign body giant cells most numerous in the region of the bismuth masses. Some are small, containing 3 to 5 oval nuclei irregularly arranged, others are larger and contain 10 or more nuclei. Some of the giant cells as well as the endothelial-like cells are seen to have a phagocytic tendency.

in the formation of inflammatory growths. We would submit the following factors and precautions to be exercised in the discriminate use of bismuth paste:

The force with which it is introduced should be minimized.

It should not be used in superficial structures like the tear duct and sac, especially in the presence of chronic infection and blockage.

It should not be used in tuberculous processes, when located quite near the surface in the soft tissues of the body.

It should not be used in sinuses in which the walls are not intact; and,

It should not be used particularly in parts of the body where there is a large amount of muscular activity.

The phagocytosis with the production of the giant cells which occurs in paraffinomata and vaselinomata occurs here and represents nature's response in their effort to restore a much disturbed circulation. The clinical picture as well as the histological one is strikingly like that of paraffinomata and camphor oil tumors. Time enough has not elapsed fully to determine as to whether there is or is not a tendency toward malignant formation. However, as was stated before there has been noted a slight tendency toward keloid formation.

AUTHOR'S NOTE—The author wishes to thank Drs. Ludwig Hektoen and I. Pilot for their kind aid in the histological study of these tumors.

Since the presentation of this subject five such cases of tumor formation have been observed and further study is contemplated.

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Fig. 8. Showing additional layer of hæmostats applied in tier arrangement horizontally, tissue being cut away as section of gland advances. Method of grasping gland so that index finger presses on the isthmus, counter-pressure being made by the thumb and bleeding controlled.

A Technique of Thyroidectomy.—**Frank H. Lahey.**

DEPARTMENT OF TECHNIQUE

A TECHNIQUE OF THYROIDECTOMY

By FRANK H. LAHEY, M.D., F.A.C.S., Boston

In the course of thirteen hundred thyroid operations it is but natural that the operative plan should have been modified several times in the endeavor to simplify and shorten the operation, to make more certain the security of those structures exposed to danger, and to diminish the postoperative emergencies and complications.

While we feel that the few special instruments which we have devised to make some of the steps of the operation safer and more precise and possibly one or two steps in the procedure may be original, we make no claim to originality, since everyone must realize that most operative procedures are original only at their conception and approach full development as they are polished by repeated use and their minor defects demonstrated and overcome by the development of satisfactory measures.

We are led, therefore, to present the following technical development of thyroidectomy as used in our clinic at the New England Deaconess Hospital, because it has been employed in the last six to seven hundred operations with much greater satisfaction than the previously employed technique, with relatively few operative and postoperative complications and because it appears to us a logical plan for the rapid removal of a large amount of thyroid tissue, insuring the leaving of a definitely planned amount of thyroid tissue and protecting the recurrent laryngeal nerve and parathyroid glands to the greatest possible degree.

We employ a Kocher transverse incision with a curve just sufficient to correspond to the slight curve made by a fairly closely fitting string of beads, and have found it a distinct advantage not to make the complete transverse incision, but to carry it only about one-half way through the skin except in the exact center of the incision where it is carried down through skin fat and platysma to the prethyroid muscles. As is shown in Figure 1, blunt scissors then separate the platysma from the underlying structures as far out as the ends of the incision on either side. By means of the same scissors the skin, subcutaneous fat and platysma are cut at one time along the original incision, the latter serving to direct the line of cutting.

Fig. 1. Showing incision made through skin but not to subcutaneous fat. Platysma raised by blunt scissors without damage to the large veins on anterior muscles of neck. In most of the cases incision penetrates only half way through skin and does not show subcutaneous fat as shown in illustration.

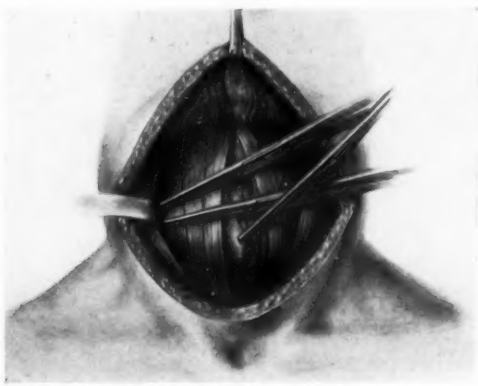

Fig. 2. Showing dissection and retraction of sternomastoid muscles from anterior thyroid muscles and clamping of prethyroid muscles, sternohyoid, and sternothyroid which are shown separately.

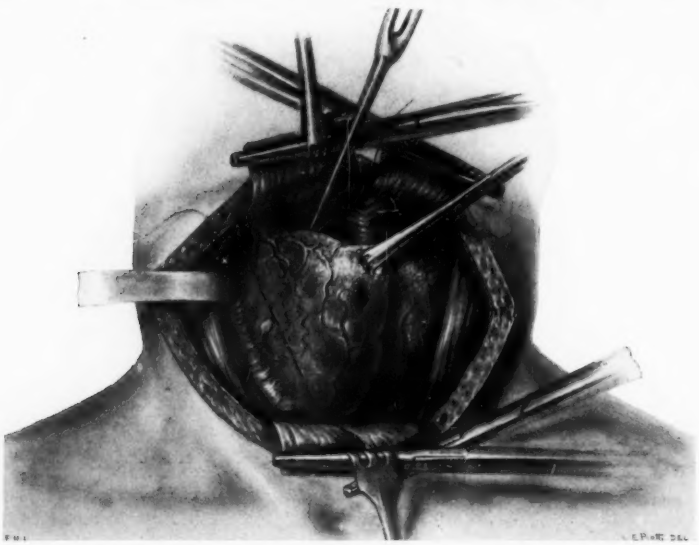

Fig. 3. Showing exposure of superior pole by retraction of internal jugular and common carotid (marked *X*) by special retractor. Spiral ligature passer shown passed around pole. Special double hook. Dotted line shown on gland to represent level at which hæmostats are applied, that part of gland posterior (showing one parathyroid) being preserved and the part anterior being removed.

By means of the above described procedure the incision is kept in its proper line, and considerable time is saved, inasmuch as the large veins running longitudinally on the sternohyoid are not cut, thus preventing much of the troublesome bleeding which occurs when the incision is carried straight through the skin and platysma to the underlying muscles.

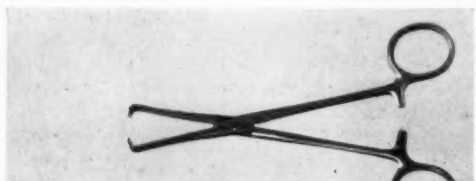

Fig. 4. Special double hook so constructed that when teeth enter gland, shanks compress gland and prevent bleeding.

Fig. 5. Special retractor of correct shape and depth for holding and retracting internal jugular and common carotid.

Fig. 6. Special spiral passer. There are holes for ligature both at tip and at neck of passer, producing bow string effect and facilitating grasping of ligature in deep hole.

The skin flap having been turned up in the usual way, we have next found it of value to dissect free the sternomastoids along their anterior edges, and by blunt dissection free the muscle from the underlying sternohyoid, sternothyroid, and omohyoid muscles. By means of this procedure it is possible to clamp the prethyroid muscles well out under the belly of the sternomastoid, to protect that muscle against incision, and to avoid the danger of catching the internal jugular vein in the tips of the clamps placed transversely across the muscles, as shown in Figure 2.

The muscles having been cut and retracted upward and downward respectively, we have found exposure, ligature, and severing of the superior pole the step which in our hands has made complete mobilization of the gland easy, its only attachment being then at the point of the branching of the inferior thyroid artery and at the place where the gland attaches itself to, and crosses, the trachea.

Ligation of the superior thyroid poles in our hands, either through the small transverse in-

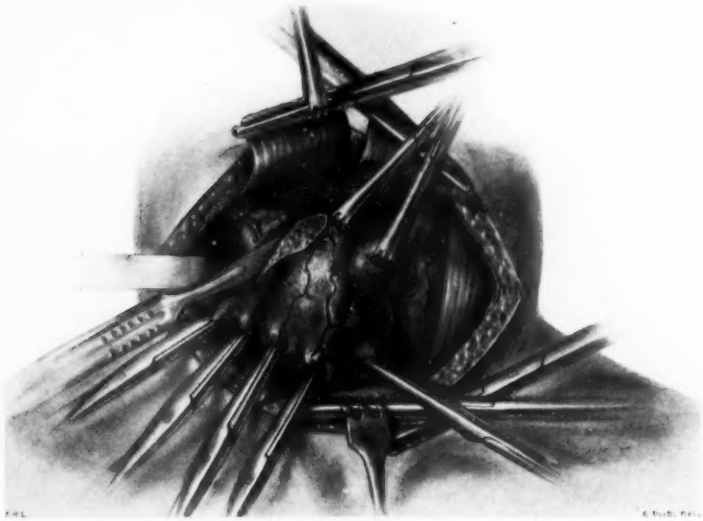

Fig. 7. Showing superior pole ligated and cut, small segment of gland being left (less than shown in the illustration). Double hooks applied and gland inverted. Posterior surface presenting hæmostats applied along dotted line shown in Figure 3, points being plunged into the gland.

cision as the preliminary measure, or as part of the subtotal thyroidectomy, has gradually developed into a procedure so planned that there can be no question but that the ligature surrounds the entire pole and includes vein, artery, and the branches of the sympathetic nerve supplying the gland, this being accomplished by passing the ligature under direct vision with the entire superior pole exposed.

If it be admitted as true that the superior pole of the thyroid with its entering vessels is frequently, if not usually, in close contact with the internal jugular vein and the common carotid artery, and that such is the case will be attested by all who deal frequently with the dissection of these structures in the living, then it becomes evident that separation of the internal jugular and common carotid from the pole and retraction outward must be the first step to insure the complete surrounding of the pole by a ligature. It is clear that otherwise a ligature which would be certain of surrounding the pole would of necessity be in danger of injuring the internal jugular and common carotid so frequently lying against it.

Our plan, then, in ligation of the pole, as shown in Figure 3, is to deliver the superior pole of the gland by means of a special double hook (Fig. 4) having jaws so arranged that after the hooks enter the gland the shanks of the forceps compress the gland and prevent it from bleeding. The pole having been delivered, the internal jugular vein and common carotid artery, exposed at the same level as the superior pole, are separated from that structure and retracted outward by means of a special retractor (Fig. 5), the blade of which we have made of sufficient depth to catch and hold both large vessels without protruding into the wound so that it interferes with the passage of the ligature. If now a pair of small blunt scissors be passed down on the inner side between the inside of the pole and the trachea it is at once clear that the entire superior pole is visualized and a ligature may be passed around it by means of a special spiral shaped passer (Fig. 6), the point of the passer being entered on the inner side where the blunt scissors separated the pole from the trachea, the spiral shape of the passer carrying it naturally around the pole until it emerges on the outer side where retraction of the large vessels prevents injury to those structures and permits clear vision of the encircling passer. The ligature is withdrawn by the manœuvre shown in Figure 3 and the pole tied firmly, care being taken to relax traction on the pole to permit snugging of the knot. For a long time we employed light braided silk, as we wished a material without elasticity and one that would cut into the tissues sufficiently to interrupt conductivity of

Fig. 9. Showing face-to-face folding of cut surface of thyroid remnant to control oozing, stitch passing through external surface of remnant and pretracheal fascia so that when knot is tied remnant is folded face to face on itself. In this illustration, first stage hemithyroidectomy only having been done, thyroid remnant is sutured to pretracheal muscle. Stump of thyroid on superior pole.

the sympathetic nerve in preliminary ligations. Although we have seen only three cases where this silk has caused trouble, we now feel that pyoktannin catgut possesses all of the qualities desired, being extremely strong, having little or no elasticity, and being, of course, absorbable.

The pole is then cut through about one-half an inch from the tie (Fig. 7), a small section of the very apex of the pole being left to prevent slipping of the ligature. With the cutting of the pole free delivery of the gland is at once possible. Another double hook is placed at the bottom of the gland and by traction inward on both double hooks the gland presents (inverted) and attached to the trachea only at its lower half or third. The middle thyroid vein is clamped, cut, and the posterior surface of the gland wiped down and examined carefully for parathyroids. By means of this procedure two important sections of the thyroid are exposed, one, the posterior surface of the gland and, the other, the inferior postero-internal portion of the gland adherent to the trachea and sheltering the recurrent laryngeal nerve in its course beneath the gland beside the trachea. Decision is made as to the amount of thyroid tissue to be left, as represented in Figure 3 by means of the dotted line, and pointed hæmostats are plunged into the gland (Fig. 7), starting either at the bottom or the top, each grasping a section of the gland within its jaws, each being applied on the level of the imaginary line represented in Figure 3 by the dotted line, until a line of snaps the jaws of which grasp thyroid tissue replace the dotted line in the figure. Each snap is applied in a horizontal plane so as to be quite accurately parallel with the table upon which the patient's neck is resting, thus avoiding the danger of catching the recurrent nerve in the points of the snaps which might penetrate the back of the gland were they plunged into the gland in any plane approaching a right angle to the plane upon which the patient's neck is resting. All of the sections of thyroid included in the jaws of the snaps are now cut through with a sharp knife and another tier of snaps applied to the remaining tissue (Fig. 8), until the trachea is reached, care being taken as with the preceding tier to apply them in the same horizontal plane. The isthmus is then removed in the same way, a little thyroid tissue being left on it if conveniently possible.

We wish to call attention to the method of holding the lobe of the thyroid, as shown in Figure 8, in applying the snaps in tiers. Notice that the thumb is applied to the external surface of the gland while behind the gland the index finger presses against the isthmus by means of which counter pressure much of the bleeding from cut vessels not included in the hæmostats may be controlled at will.

The advantages of the above procedure are, first, the fact that a definitely mapped out segment of thyroid is left behind, that section posterior to the dotted line in Figure 3, that this mapped out section protects the recurrent laryngeal nerve, that the mapped out section is protected from injury by the horizontally applied snaps and, finally, that the carefully exposed and sponged posterior surface reveals the location of possible parathyroids usually at such a site as readily to permit the inclusion and protection in the mapped out remnant to be left behind. The thyroid tissue having been cut away, each snap is ligated in turn with plain catgut, except when two or three may be ligated together without the inclusion of thyroid tissue, which might make possible an injury to the recurrent laryngeal nerve.

We have avoided the use of stitches in the thyroid remnant as it is our feeling that if success is

to be obtained in toxic goiter, particularly in the hyperplastic type of primary hyperthyroidism, large amounts of thyroid tissue must be removed, leaving only very small remaining segments of such thinness that to pass sutures through them would make possible an inclusion of the recurrent laryngeal nerve in the suture and interference with the blood supply of the parathyroids. These conditions we have been largely able to avoid, as evidenced by the fact that in over thirteen hundred thyroid operations we have had but three cases of tetany, these being only of the transitory type and all having been free from symptoms now for some months without treatment. Furthermore, we have had relatively little recurrent paralysis, we have never had a bilateral abductor paralysis and have never had to do a tracheotomy upon a patient having non-malignant goiter.

It has been our experience that even after the snaps which have been plunged into the gland are tied and after the gland is cut away, oozing may still persist at times and be of such character as to be uncontrollable by snapping, necessitating in such a case the employment of suture. In such a situation it is our custom to pass sutures only through the outer margin of the remnant well away from the area over the nerve, another bite being taken through the tissue over the trachea. After the knot is tied, the gland is so folded on itself that oozing is controlled by face-to-face pressure of the cut surfaces, Figure 9.

In closure of the neck it is our custom to suture the cut muscles with interrupted mattress stitches accurately applied about veins to control bleeding and to prevent postoperative hæmorrhage (Fig. 10). In the first half of our series of cases we took considerable pains to suture the platysma muscle, while in the latter half of our cases the platysma has been entirely neglected. We are now of the opinion that its suturing has no effect upon the scar and that because of the fact that it places additional catgut close to the cut skin it increases the incidence of serum pockets in the wound thus producing adhesions and interference with the symmetry of the scar.

We shall not discuss further steps in the technique of subtotal thyroidectomy, as it is the purpose of this paper, not to explain the technical steps of an operation already well known, but to present those developments which, in our hands, have added to the safety of the operation and lessened its complications.

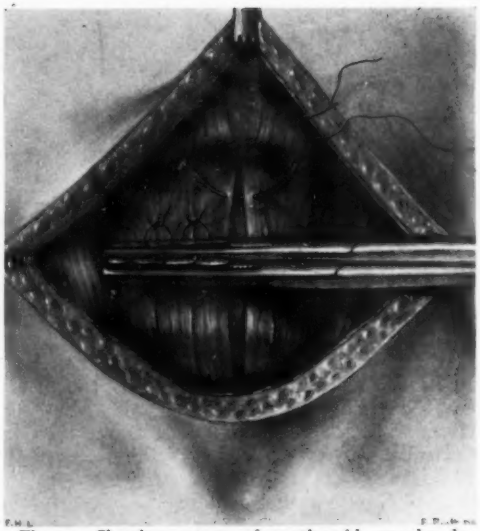

Fig. 10. Showing suture of prethyroid muscles by mattress stitch to control bleeding. Longitudinal suture of muscles in median line. Sternomastoids intact.

To epitomize our views:

1. We feel that if pole ligation is to be done in a sick patient too ill to endure more extensive surgery, we should be absolutely sure that the entire pole is ligated. In our hands the method most certain to accomplish this end is the one described above.

2. One should be certain that a large amount of thyroid tissue is removed, and equally certain that a definite amount is left behind. We feel that we have made certain of this by the inverting of the gland and application of the snaps so as to map out the part to be removed and the part to be left.

3. This technique has, in our hands, made control of bleeding satisfactory and certain, a factor which, in our opinion, has much to do with the elimination of tetany, recurrent paralysis, and many of the other possible complications of this operation.

FRACTURED SPINE; CONSIDERATION OF THE PRACTICAL CARE AND TREATMENT[1]

By WALTER C. G. KIRCHNER, A.B., M.D., F.A.C.S., St. Louis
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THE subject of fracture of the spine has received a good deal of consideration from the standpoint of diagnosis and surgical treatment, in which instance the lesion itself has attracted the greatest amount of attention, while on the other hand there has not been enough interest shown in matters relating, as a whole, to the general care and welfare of the patient. No matter how well the operative or general surgical treatment may be directed, unless the entire course of treatment of the patient be taken into consideration the results are not likely to be favorable. It is a discussion of this latter phase of the subject to which I wish particularly to call attention. We shall be interested chiefly in the graver lesions in which the spinal cord is involved and in which there is a definite paralysis.

During the past 20 years in general hospital service as well as in the military service I have had occasion to treat a considerable number of cases of fracture of the vertebræ. All degrees and types have been encountered. For our purpose, however, I shall present only a single case which offers a number of interesting points for discussion. A brief synopsis of the history of this case is as follows:

Case 1. Mr. J. J. L., age 51, a mechanic, on August 4, 1919, while in an excavation and while straddling a pipe, was crushed by the wall which caved in and buried him completely. He was rushed to a hospital where it was found that he was in great shock, had suffered a fracture of the vertebræ, and that the lower limbs were completely paralyzed. The roentgen examination disclosed a pronounced dislocation of the third and fourth vertebræ and fracture of the transverse processes of these vertebræ (Fig. 13). He was placed on a Bradford frame and Buck's extension applied to both lower extremities. This form of treatment was continued for 3 weeks when a second roentgen examination was made, and it was found that the deformity was somewhat less (Fig. 14). On account of the irritation to the skin caused by the adhesive strips, the extension had to be discontinued, and he was placed in a fracture-bed. On October 15, 1919, I was called into consultation and noted the following condition: The patient was weak and emaciated, the ribs were prominent; the heart action was feeble and he was easily exhausted; he could not move the lower extremities. The knee-jerk and plantar reflexes were absent. The cremasteric reflex was present and was more marked on the right than on the left side. There was no anal reflex. Sensation was present on the anterior aspect of the right lower extremity and extended as far as the great toe and inner side of the right foot. There was some sensation on the interior aspect of the left thigh but not below the left knee. There was incontinence of urine and fæces. In the sacral region there was a large bed-sore. On November 11, 1919, when I was given complete charge of the case, the neurological findings were about the same and very slight muscle movement was detected in the right thigh. Foot-drop was pronounced. The heels of both feet were black. The bed-sore on the back was 5 inches in diameter and the muscular coat of the rectum and the bare sacrum were exposed. The margins of the bed-sore were undetermined for a considerable distance. There was œdema of the penis and of both lower extremities. He was able to be propped up in bed but was still very weak. Fæces were impacted in the rectum, and there was a pronounced cystitis. There was no control of the bladder or rectum.

Splints were applied to both feet and legs to correct the foot-drop and to relieve pressure on the heels. The bed-sore was strapped with strips of adhesive plaster to aid in drawing together the margins of the wound (Fig. 3). A strong and firm plaster shell extending from the shoulders

Fig. 1. Decubitus following fracture of the spine. The large bed-sore exposes the sacrum and the posterior wall of the rectum. The wound margins are undermined for a considerable distance by sloughing necrotic tissue. (Service Unit 1, Washington University, City Hospital.)

Fig. 2. Strong, well-padded and comfortable plaster shell applied to the back and held in position by a sand bag. The shell is cut away at the lower part to relieve pressure over the bed-sore and to permit of easy dressing of the wound.

[1] Read at the meeting of the Southern Surgical Association, Memphis, Tennessee, December 12, 1922.

Fig. 3. Method of supporting and treating bed-sore by means of strapping, lattice fashion, with adhesive strips. The traction assists in the healing process and greatly diminishes the size of the bed-sore by approximating the true skin margins.

Fig. 4. Effect of treatment on a bed-sore which was over 5 inches in diameter. Wound almost entirely closed in by true skin. A deep, perforating trophic ulcer over the left tuberosity is indicated by a rubber tube for treatment with Dakin's solution.

to the hips was applied to give support to the back and to relieve pressure on the bed-sore (Fig. 2). The application of the cast occasioned a chill and tremors, though the temperature and pulse rate remained normal. On November 25, 1919, with casts and shell applied he was removed to his home and placed in a fracture-bed. The shell furnished a useful means of transportation. At his home the bed-sores received constant attention. The cystitis was treated and the bowels were kept properly regulated. A Balkan frame was installed early in December and the lower extremities were swung hammock-like in Hodgen splints, thus assisting in voluntary muscular movements (Figs. 5 to 8). The patient received massage daily. By December 20, slight adduction and abduction of the right thigh and flexion at the right knee were noticed and also slight adduction of left thigh. The œdema of the penis, scrotum, and hips had been reduced. At times there were shooting pains in the left limb. The patient grew fond of his shell and gained in general health and strength. By February 1, 1920, a deep, trophic ulcer had developed in the left buttock over the tuberosity, and all the other wounds showed improvement (Fig. 4). On February 11, the patient had a chill and the temperature was elevated to 102.6°F. There was a slight mucopurulent discharge from the rectum. On the following day the temperature was reduced, but there was a reddened area about the left hip resembling erysipelas. The area of redness migrated downward along the thigh and disappeared in 3 or 4 days.

On April 25 the patient again experienced severe shooting pains in both lower limbs, extending into the feet. The left foot was more painful than the right and a sedative was required to give relief. The next morning there was œdema and redness about the left hip. The inflammation again descended, this time as far as the foot. The right thigh was also reddened. The temperature was 100° F., pulse rate 100.

On May 6, 1920, the patient was taken to a hospital for roentgen examination and returned to his home, where on the next day a neurological examination made by Doctor W. W. Graves showed the following:

"The general nutrition is fair, though there is still marked general emaciation. There is marked wasting of the muscles of the lower extremity on the right, and so far as can be determined by palpation, there is no muscle tissue remaining in the right leg. There is fairly good quadriceps function. There is slight adduction and inward and outward rotation at the hip. There is also slight function retained in the inner hamstring muscles. There is marked tendency to foot-drop and supination of foot on the right, also on the left. No muscle tissue can be palpated about the left leg. Quadriceps group is wholly atrophied; abduction and extension of hip nil; adduction and inward rotation fair. It is noted that urinal is kept in constant position. Left knee-jerk is absent; right knee-jerk is present. Sensation on left to pin pricks and apparently in all other qualities of sensation is wholly abolished below the knee; retained about the anterior and outer aspects of left thigh and to the knee joint on the outer surface and to within 4 inches of the knee joint on under side. Sensation is preserved on the outer and upper third of right thigh, as to the right lower extremity sensation is profoundly disturbed about the outer surface of right leg and greater portion of foot; otherwise sensation is fair about this extremity. There is complete loss of sensation in the gluteal region in a zone corresponding to the distribution of the third, fourth, and fifth sacral roots. There is a scar over each heel from decubitus."

The roentgenologic report of Dr. E. H. Kessler was as follows: "The third and fourth lumbar vertebræ are dislocated, and there is a fracture of the transverse process and of the inferior articular process of the third vertebra. The fourth lumbar vertebra is fractured through the transverse process and the superior articular process is also fractured. The dislocation is lateral and anteroposterior."

A small rectal abscess developed which was operated on June 23, 1920. On July 8, there was slight voluntary flexion of left knee, though flexion of right knee was quite complete, and the entire right limb in extension can be raised and flexed at the hip.

On August 21, there were severe shooting pains in both lower limbs, the temperature was 101°F., and as on previous occasion redness of the skin developed about the hips and migrated toward the feet. The reddened area was painful and was hotter than the surrounding skin. This pain, elevation of temperature, and reddened skin recurred on October 22, and again on March 21, 1921.

Since July 23, 1921, patient has slept at night without a cast or shell. During the day he was placed in a wheel-chair (Fig. 10). Since November 14, by employing the abdominal muscles he was able to expel urine and regular catheterization was discontinued. On December 11, he was able with assistance to get out of bed and into the roller-chair without the use of his swing. He has daily taken exercises to develop the atrophied muscles and to regain locomotion. The rectal function has shown improvement and he now has moderate control. The bladder function is still inadequate though during the day he manages to hold the urine about 2 hours. During the night he is obliged to provide himself with a urinal. Since the patient has been able to be about, the bed-sores have healed, the shooting pains are less severe and he has improved markedly.

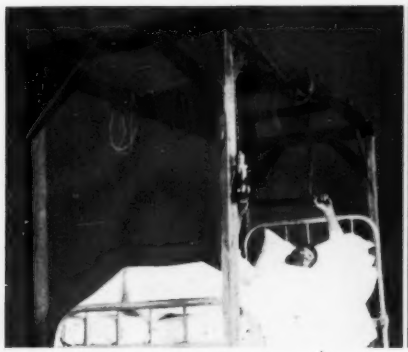


Fig. 5. Frame-work (Balkan frame) of home construction which has been erected over bed to facilitate the handling and treatment of patient.

Fig. 6. Method of supporting lower extremity by means of soft pads and pillows to prevent bed-sores. The heel should be kept free to avoid pressure sores. The atrophic muscles as well as other parts of the body are massaged daily and all joints are manipulated.

Fig. 7. A suitable fracture-bed permitting of easy elevation of trunk to sitting position and of satisfactory use of bed-pan by lowering of middle section. The trapeze enables the patient to lift himself thereby materially assisting the nurse in the care of the patient. An elastic supporter may be used to correct foot-drop.

Fig. 8. The frame enables various types of apparatus and treatments to be put to use. The sling for the leg permits of easy adduction and abduction of the lower extremity. The foot is always supported so as to correct foot-drop.

Cases of fractured vertebræ must be considered with regard to the treatment of the immediate condition and also with regard to the secondary and remote complications following injury to the spine and cord. The primary handling of the case is concerned with the treatment of shock, the reduction of fracture or dislocation either by manipulation or operation, the relief of pressure on the cord, the treatment of the bladder and the rectum when paralyzed, and the treatment of respiratory and cardiac complications. In certain cases it is difficult to determine whether or not resort should be had to immediate operation in order to relieve symptoms of compression of the cord. The subsequent care of the patient demands appropriate treatment directed toward the cure of bed-sores, trophic disturbances involving the different tissues, œdemas, abscesses, cystitis, neuritis and other nerve lesions, atrophy of muscles, and the prevention of infection and sepsis.

Patients suffering with fracture of the vertebræ and injury to the cord with paralysis die as a result of shock or paralysis of vital functions, or more remotely as a result of sepsis and a state of inanition. Bearing this in mind, special attention must be paid to all objective as well as all subjective symptoms. The incontinence of urine and fæces, decubitus, the results of trophic changes, pulmonary and cardiac symptoms demand very careful consideration and attention. As a factor in prognosis and treatment, due regard should be had for all subjective symptoms.

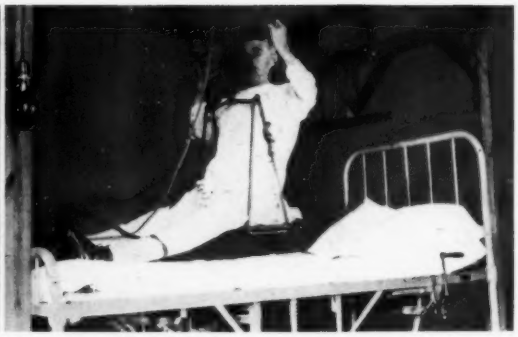


Fig. 9 (at left). Patient in shell elevated to sitting position thus relieving pressure on the back. The position improves the circulation and the general health of the patient. He is also thus enabled to feed himself.

Fig. 10. In the recumbent position the seat of the swing is placed under the buttocks. When the patient is raised to the sitting position the ropes and pulleys of the swing are adjusted. The back-rest having been lowered, the patient in the swing is easily elevated, the bed is removed to one side and in its stead is placed a roller-chair into which the patient is lowered. The bed-ridden patient is thus enabled to get about.

The patient's mental condition and habits should be studied, so that a hopeful attitude toward recovery may be encouraged. The character of the so-called root pains and the various nervous manifestations and sensations are often a guide as to the progress of the case. The root pains may be so severe that sedatives and even operation may be required to give relief.

The lack of proper bladder function is a very distressing complication. If possible cystitis is to be avoided and this condition is only too often invited by catheterization which a distended bladder seems to call for. Unless the pain and bladder distention are too great, catheterization should be avoided for fear of infecting the bladder. Overdistention of the bladder with incontinence is safer than faulty catheterization. When catheterization must be resorted to, the bladder should be irrigated with sterile boric acid solution and followed by argyrol, or other antiseptic solutions should be instilled to control infection.

The incontinence of fæces can be properly controlled. The stools should be kept soft, and this can be accomplished by the proper administration of liquid petrolatum or similar preparation. At times a cathartic may be required. A cleansing enema given daily will keep the patient in a clean and satisfactory condition.

The bed-sores (Fig. 1) are the result of trophic changes and long-continued pressure on the skin. In handling bed-sores pressure areas must be avoided. Alcohol, bismuth preparations, etc., which harden and toughen the skin are better than oils and ointments which soften the skin. I have found Dakin's solution and hyclorite solutions of appropriate strength, very efficient in cleaning up sloughing bed-sores. It may be necessary to employ tubes so that the wound may be frequently treated with the solutions. Large bed-sores

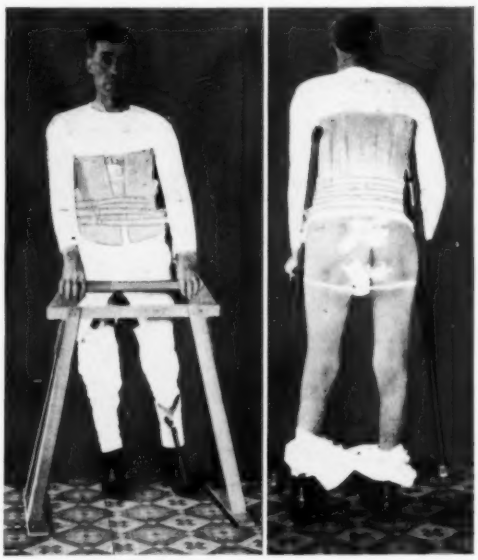


Fig. 11 (at left). Locomotion is enabled by means of the "perambulator" which when placed a short distance in front of the patient, enables him to drag himself forward or to take steps as in walking. The patient's back is supported by a corset which the writer had specially designed.

Fig. 12. The patient is also taught how to use crutches and in the beginning the tripod method of locomotion is most useful. The upright position permits the bed-sores to heal more rapidly. Weight-bearing strengthens the knees and also seems to re-establish the sense of equilibrium.

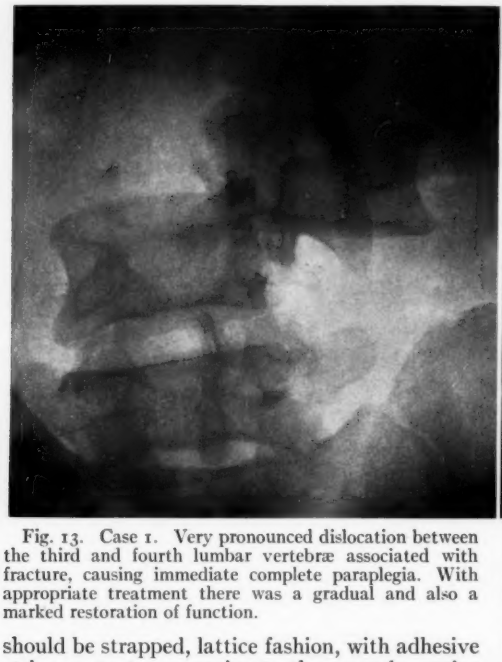


Fig. 13. Case 1. Very pronounced dislocation between the third and fourth lumbar vertebræ associated with fracture, causing immediate complete paraplegia. With appropriate treatment there was a gradual and also a marked restoration of function.

Fig. 14. Case 1. Shows improvement in alignment of vertebræ after application of traction for 3 weeks. (The author is indebted to Dr. M. L. Klinefelter for the roentgenograms, Figures 13 and 14.)

should be strapped, lattice fashion, with adhesive strips so as to approximate the wound-margins and thus to relieve tension and the tendency to enlarging of the wound (Fig. 3). Scarlet red ointment is useful in stimulating epithelial growth. Balsam of Peru in castor oil and other ointments are useful at times. Superabundant granulation may be controlled by the use of tincture of iodine. The healing of wounds is a special study, and each wound and often the different parts of the same wound, may require different treatment. It is often necessary to vary the procedure in the treatment of a wound according to its special demands and requirements. The importance of this latter fact is often not appreciated.

The therapeutic measures must be applied as the special indications require. Massage of the entire body and especially of the affected extremities is necessary to keep up the tone of the muscles and to keep the joints supple. Massage of the scars of healed ulcers is useful in making the skin mobile, pliable, and more resistant. The beneficial effects of massage cannot be overestimated.

A patient suffering a paralysis as a result of fracture of the vertebræ is so helpless that mechanical means is required to furnish aid and comfort. Appropriate splints or supports should be adjusted to the lower extremities to prevent decubitus and foot-drop (Figs. 7 and 8). The plaster shell is an efficient means of making the patient comfortable, preventing or treating bed-sores and of easy transportation and handling of the patient while in bed (Fig. 2). A properly applied shell also helps to correct deformity of the spine. When the shell may be dispensed with, a removable body cast takes its place. As the condition improves the cast is replaced by a plaster jacket or corset of special design (Figs. 11 and 12). An adjustable fracture bed is almost essential in the proper handling of the patient (Fig. 7). A properly constructed framework over the bed (Balkan frame) is so desirable that it should form a part of the equipment in treating the patient. The frame permits the patient to be supported and by means of pulleys, ropes, slings, splints, swings, etc., various movements of the body and limbs are made possible. The frame enables the patient to take the first steps toward getting out of bed, and thus hastens convalescence (Figs. 5 to 10).

The nursing of the patient with a fracture of the back is exceedingly important. There are many things regarding the proper care of the patient which are unusual and disagreeable and there is a great tendency to shirk responsibility. Often the cases are considered hopeless, and the nurses

and attendants show a lack of proper interest and perform their duties in a mechanical and perfunctory manner.

The inability of the patient to help himself and the difficulty of handling the patient make the case a trying one. It is the incontinence of urine and fæces that is the source of greatest annoyance, and in proportion to the mastery of these complications depends the success in the treatment of the case. The nurse who is successful in these cases knows the value of extreme cleanliness and care. The hair about the genitalia should be shaved so that the parts may be kept surgically clean. The urinal should be of the proper type so that leakage and soiling is avoided. The bowels must be kept properly regulated and cleansing enemas should be given daily. The bed clothing must be kept dry and clean. I have been able to train housewives for this type of nursing who have succeeded better than the trained nurse because of their extreme interest and attention to detail. The nourishment, hygienic surroundings, ventilation, and attention to the mechanical adjustments are important factors in the treatment. Extreme patience and care are required and when these virtues are made a part of the intelligent treatment, favorable results may eventually be expected.

In concluding I wish to make a plea for a more hopeful attitude in regard to the prognosis in cases of fracture of the vertebræ. Intelligent nursing, cleanliness, the proper care of the bladder and bowels are important factors in the treatment. The plaster shell, the Balkan frame, and a suitable fracture bed are also important adjuncts. In the treatment of bed-sores the surgeon must master the principles of wound healing. Attention must be paid to the patient's psychic condition, and occupational therapy in this type of cases finds an important place. The active and paralyzed muscles must be studied and the surgeon must select exercises and movements so that inactive muscles may be developed and so that proper re-education of muscles may be made possible. With attention to these details, the surgeon may sometimes be rewarded by a favorable outcome in a type of case of fractured spine that were considered hopeless.

A NEW SACRO-ILIAC SUPPORT

By JOHN McWILLIAMS BERRY, M.D., F.A.C.S., Albany, New York

IT is possible to support and hold together a disarticulated human pelvis by the pressure of one or two fingers on either side (Fig. 1). The proper point for pressure on either side is limited to an area about 2.5 centimeters in diameter on the outer surface of the ilium opposite the knee of the sacro-iliac joint. If pressure is applied over any other two areas than the above the pelvis falls apart. Corresponding areas on the surface of the body are situated just posterior to the upper end of the greater trochanter of the femur and there are normally depressions in the buttocks at those points.

Many sacro-iliac supports that have been devised press against the crest of the ilium or other parts of the pelvis and tend rather to displace than support the sacro-iliac joints.

The object of the brace herein described is to give lateral support to the pelvis over the points at which experiment has shown that the disarticulated pelvis can be held together.

The brace (Fig. 2) consists of two pads, *A* and *A'*, joined by a thin bar or band of flexible tempered steel, *B*. The length of the steel band is such that the pads fit into the depressions on

Fig. 1. Disarticulated pelvis held together by pressure exerted by two fingers on either side.

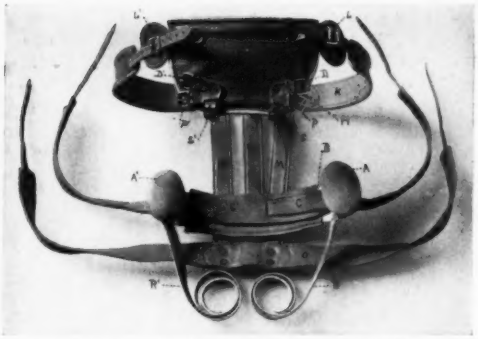


Fig. 2. Brace showing parts as described.

the buttocks which correspond to the proper points of pressure to support the pelvis. The strap, C, is attached back of the pad, A, between it and the steel band, and runs across the front of the steel band through a slit in the strap, C', and out posteriorly through a slit in the steel band near the pad A'. It is then brought around the body and is fastened to an abdominal pad, E, by a buckle at D'. A similar strap, C', runs from the pad, A', out through a slit in the steel band back of pad, A, and is fastened to the abdominal pad by a buckle at D. When these two straps are tightened, it will be seen (since the pads can not slide toward each other), the steel band bows backward and the pads exert lateral pressure. The lateral pressure is further increased by the pressure against the pads as the straps are brought around the body and fastened in front.

At the back of the brace a steel upright, F, is riveted to the flexible band already described and also to a second band, H, at the waist level of the body. From the ends of the waist band two straps, K and K', run obliquely down and forward just above the iliac crests and are fastened to the abdominal pad by buckles at L and L'.

From the back of the waist band two steel bars, M and M', extend downward on either side of the steel upright, F, connecting the pelvic and waist bands. The steel bars, M and M', are fastened together a short distance below the pelvic band but are not attached to it. When the straps, O and O', are tightened and buckled to the abdominal pad at P and P', the pelvic band which was previously bowed back is brought forward again thus giving the pads, A and A', a forward pressure in addition to the lateral pressure they were already exerting.

The straps R and R' are perineal straps that are fastened to the abdominal pad at S and S'.

AN INSTRUMENT AND METHOD FOR ASEPTIC ANASTOMOSIS OF THE INTESTINE[1]

By FREDERIC E. B. FOLEY, M.D., St. Paul, Minnesota
Miller Hospital Clinic

In 1910 the late Dr. William S. Halsted described an end-to-end suture of the intestine by what he termed a "bulkhead" method (1, 2),[2] its distinguishing feature being an essentially aseptic technique. In brief, the method consisted in abutting and suturing the ligated and seared ends of bowel with later re-establishment of the intestinal lumen by destruction from within of the obstructing bulkheads after completion of the suture. The method was presented as an experimental study and full cognizance was taken of the fact that it was only developmental, improvements and perfections in the technical details being essential before it could be accepted for use in the human subject.

With a view to stimulating interest in these desired improvements and in the problem of aseptic anastomosis in general, it was Dr. Halsted's habit to demonstrate this operation to the students in operative surgery at the Johns-Hopkins Medical School. The writer's interest in the subject began with one of these demonstrations. Other workers in the Hunterian Laboratory were already engaged in experimentation on the problem, among them the late Dr. Ernest Grey. By a cleverly contrived method of releasing the bulkhead ligatures (3) he sought to re-establish the bowel lumen after completion of the suture. The writer attempted to accomplish the same thing by amputating the ligated bulkheads by means of specially devised tonsil snares. Neither method, however, represented any real improve-

[2] The ingenious method had been proposed by Dr. W. D. Gatch, at the time an assistant to Dr. Halsted.

[1] From the Laboratory for Surgical Research, Harvard Medical School, Boston, Massachusetts. Received for publication, January 22, 1923.

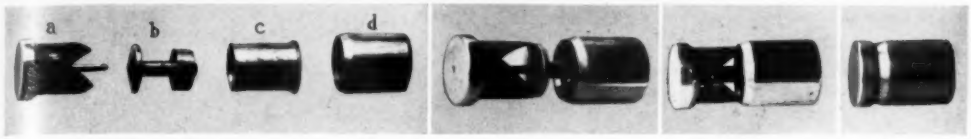


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Parts of instrument and instrument assembled.

ment over Halsted's original scheme and the latter one gave less assurance of perfect asepsis.

At this time (spring, 1917) the writer proposed in the Hunterian Laboratory the design for an instrument to be placed within the invaginated bulkheads in such a way that, after completion of the suture, pressure on the instrument from without would cause it to cut through the bulkheads, thus re-establishing the intestinal lumen. Walter C. Burket, one of the workers in the Hunterian Laboratory of that time, has recently published the description of an instrument (4) in which the essential feature of the instrument proposed by the writer in 1917 seems to have been employed.

During the past year, Dr. Halsted described another variation of the method (5) for use in the large bowel. In this procedure the bulkheads are cut open by a protected knife passed up the colon from the anus. More recently (December, 1922) Collins (6) and Horine (7) have described methods for aseptic anastomosis. These, however, are only variations of the principle embodied in Grey's release ligature. One of these methods (Horine) has been employed in the human subject.

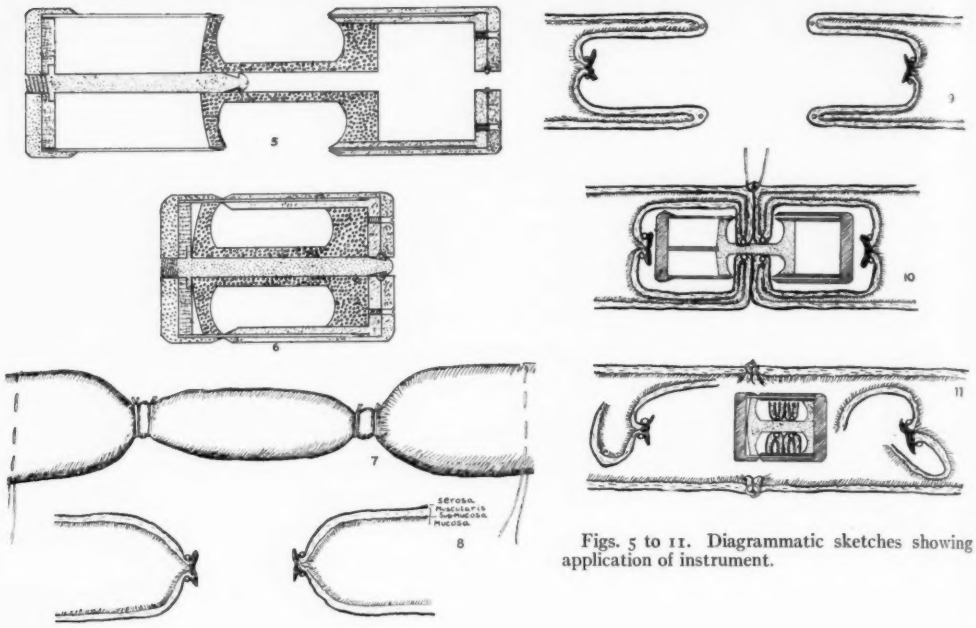
It was not until 1919, in the Laboratory for Surgical Research at the Harvard Medical School, that opportunity was afforded the writer to construct and experiment with the instrument, the design for which had been proposed 2 years previously. It is felt, however, that the instrument devised is a more practical development of the scheme than the instrument described by Burket.

DESCRIPTION OF INSTRUMENT

The instrument consists of the four members shown in Figure 1. The metal cup, c, fits into a similar but somewhat larger cup, d. The two are held together, as shown in Figure 2, by two small screws through their bases. One end of the spindle, b, Figure 1, fits into the inner one of these cups like a piston in a cylinder. The member shown in *a*, Figure 1, consists of a V-sectioned cylindrical knife blade held securely in a base. A round metal pin rises from the center of this base. In the assembly, Figure 2, this pin is shown engaged in the end of a hole which extends through the axis of the spindle. The instrument thus assembled may be telescoped together as shown in Figures 3 and 4. As the instrument collapses, the knife blade is received and encased in the space between the walls of the cups, one end of the spindle slides into the inner cup like a piston, while the other end is received within the knife blade. In Figures 5 and 6 the different parts of the instrument and their relations after telescoping are shown in cross section. The way in which the instrument locks in the telescoped position is also shown here; the groove near the end of the pin engaging a wire clip between the bases of the cups.

TECHNIQUE OF OPERATION

The portion of bowel to be resected is doubly ligated at two points, preferably with wire, Figure 7. Division between each pair of ligatures is made with the cautery, thus giving two sterile closed stumps of intestine, Figure 8. Some distance from the end of each stump a purse string suture is passed around the bowel. Each stump is now invaginated until the purse string is at the edge of the invaginated cuff, Figure 9. The instrument assembled as in Figure 2 is inserted into these two invaginations and the purse strings are tied down on the spindle, Figure 10. End-to-end suture of the abutted serous surfaces is now made. Interrupted mattress stitches are passed deep enough to include the submucosa. By including the submucosa, hæmostasis is secured and a strong line of union is made. On completion of the suture the segment of bowel containing the instrument is taken in the hands and pressed together in a longitudinal direction. As the instrument telescopes, the knife blade, beginning with the two points, is driven through the four thicknesses of bowel forming the bulkheads and their attachment at the suture line. In this way the obstructing bulkheads are cut out, the intestinal lumen re-established and the instrument liberated in the bowel cavity, Figure 11. The whole procedure has been carried out with complete asepsis, the bowel lumen having been opened at no time and not even a release ligature having been re-



Figs. 5 to 11. Diagrammatic sketches showing application of instrument.

moved through the suture line from the intestinal cavity after completion of the anastomosis. The instrument may now be milked along the intestinal tract to remove it from the site of operation. In fact in operations on the colon it has been found possible to move it into the rectum and expel it from the anus.

COMMENT

The present instrument was devised after experiment with two simpler, though less satisfactory, designs in which the spindle member was omitted. The first of these is more closely the plan of the instrument recently described by Burket (4). It consisted of two parts: one corresponding to the cups *c* and *d* in Figure 1, and the other a cylindrical knife blade the cutting edge of which was a complete circumference. The base of each part was flattened like a thumbscrew so that, as the two members were pressed together, the knife blade could be rotated back and forth. A secure grip on the thumbscrew shaped ends of the instrument was impossible because of the two thicknesses of surrounding bowel. The procedure gave an undesirable manipulation of the suture line. These difficulties made the contrivance impractical. It is difficult to see how they are overcome in Burket's device.

After some encouragement from the ease with which ordinary safety razor blades could be pushed through several thicknesses of bowel, a second instrument was constructed which dispensed with the rotating feature of the knife altogether. The groove into which the knife abutted was filled with paraffin as a block on which the layers of bowel could be cut, making contact of the blade with metal unnecessary. After completion of the suture, the two members were simply pressed together. The knife blades it was possible to construct did not approach in keenness the ordinary safety razor. With such blades it was soon found that the amount of pressure necessary to exert on the instrument in order to cut through the bulkheads, so damaged the bowel wall as to make the procedure impractical. With the two pointed knife of the final instrument this force is so reduced that no appreciable damage to the bowel wall results.

Though complete asepsis is not the *sine qua non* of intestinal anastomosis, it is sufficiently desirable to warrant investigation into methods capable of securing it. William S. Halsted considered it a sufficiently important problem to devote much time and thought to such experimentation. It may be said at once, however, that the amount of soiling which occurs with the ordinary methods

of intestinal anastomosis is not a factor of sufficient importance to warrant subordinating simplicity, speed, and strength of union (the Connell method) to a more involved technique the sole object of which is asepsis. Any procedure which secures asepsis at great expense in these matters will not be accepted for use in the human subject.

Operations on living dogs have shown the instrument and method described to be entirely practical within the limits of experimental surgery. Simplicity, speed, and strength of union are not sacrificed sufficiently at once to exclude the method from all possibility of employment in the human subject. Further perfections in the device and possibly in the details of the technique should first be developed.

Familiarity with the procedure described convinces that, though based on a seemingly complicated mechanical device, it is no more difficult or involved than anastomosis by the ordinary methods. The mounting of the bowel on the instrument in position for suture has proved very convenient. Anastomosis by the usual methods is made by a through-and-through suture in order to insure hæmostasis and firm union. In actual experiment with this method, it has been found that if a single row of serous-serous mattress sutures, including the submucosa, is employed, no appreciable bleeding results[1] (the operator learns to feel the resistance of the submucous coat). Upon sacrificing several animals after intestinal suture of this sort no evidence of leakage could be found (1, 3, 5, 10 and 30 days after operation).

The question may be raised as to the actual asepsis of the ligated and cauterized stumps of bowel. We have no bacteriological data bearing on this subject, but it is difficult to believe that organisms can survive a heat sufficient to char the tissue and material surrounding them.

The amount of bowel sacrificed in making the bulkheads might preclude the use of the method in certain situations.

One difficulty experienced was the tendency of the submucous coat to be dragged into the crevice between the cups at the points where the V's of the knife cut through the bowel. With the blade well sharpened this did not occur. The difficulty can be entirely overcome by a well-sharpened knife blade of high grade steel fitting snugly into the crevice between the cups.

Steel construction of all the parts gives the instrument undesirable weight. Aluminum can be used for all except the knife blade and grooved pin. An instrument embodying these improvements in construction and materials was to be made before making a formal report. The present paper is published at this time, however, in the interest of the writer's priority and because it is felt that it gives a technique of aseptic anastomosis superior to those recently described.

[1] For a critical comparison of the real merits of penetrating and non-penetrating sutures in intestinal anastomosis, see page 360 of the article (5) by Halsted.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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JUNE, 1923

THE LIMITATIONS OF CÆSAREAN SECTION

IT is an established fact that the scope of any surgical procedure widens as the technique is perfected, and as the mortality and morbidity are reduced. Cæsarean section has not been an exception to this rule, and because of the popular belief that it has been made a comparatively safe procedure, there is no doubt but that serious abuse of the operation is now prevalent. It is being performed upon unsuitable cases, in unsuitable surroundings, by surgeons who apparently disregard the wonderful adaptability of nature, who ignore the other tried and established obstetric procedures, and who seem to justify its employment upon surgical grounds rather than upon the obstetric indications for operative interference.

The outstanding fact to be kept in mind in estimating the true value of cæsarean section is that the perfection of operative technique has been by no means the only important factor in reducing the mortality. It has been markedly reduced only in properly selected cases; and when due regard has not been paid to the complications that may arise so insidiously in delayed labor, it promptly approaches a figure that places cæsarean section among the most serious abdominal operations. The average mortality in selected cases is estimated at about 2 per cent, and many obstetricians have reported large series with no fatalities, but the records of the average hospital will show a mortality of more than 10 per cent, and superior operative technique cannot altogether explain this discrepancy. The ideal results reported by Reynolds, Kerr, Williams, Hirst, and others are obtainable only when the operation is performed at the elective time on properly selected cases. The fact is not always appreciated that the risk increases hourly after the onset of labor, approaches 10 per cent after the second stage is well established, and may reach 25 per cent in exhausted or infected cases. Moreover, Kerr and Holland's recent exhaustive study shows that the mortality reaches 27 per cent when forceps delivery has been attempted prior to the operation. In view of such facts it must be admitted that cæsarean section has its limitations, and these figures prove that wide experience and judgment in the selection of cases are as important factors as is the operative technique.

Aside from the unwarranted risk attending the operation in improperly selected cases, the question of future pregnancies must be considered. Rupture of the uterine scar in subsequent labor occurs too often to be ignored. If it is agreed that only women who have had a normal convalescence following abdominal delivery should risk a subsequent spontaneous delivery, about 40 per cent of our cases would require a repeated section. This fact alone

prompts the conscientious obstetrician to urge definite indications for abdominal delivery.

Contracted pelves present perhaps the most definite indication for the performance of cæsarean section, but even here the best authorities agree that 75 per cent or more will deliver spontaneously if serious disproportion does not exist. This cannot be too forcibly emphasized at this time, when the indications for operative interference appear to rest largely on the fact that there is a contraction, regardless of the degree. Careful pelvimetry prior to the onset of labor, and section, if necessary, at the elective moment is the only wise course in such cases; the decision should be made before, and not after, labor has progressed until it is a question of performing cæsarean section or doing craniotomy as a last resort.

Craniotomy still has its indications in protracted labor, and while it is repugnant to destroy a living child, so should an abdominal operation be that demands such a heavy toll as is usually paid in exhausted or infected women. Its useful, if limited, field must be recognized in neglected or infected cases, for when properly done, mortality rarely approaches that of cæsarean section in similar instances.

It was hoped that extraperitoneal section would solve the difficulties encountered in neglected and infected cases, but while the mortality has been somewhat reduced, the results are not what had been anticipated. Section combined with hysterectomy probably gives the best results under the circumstances, but it is a frightful price for a young primipara to pay on the supposition that she may develop a serious infection.

The treatment of placenta prævia by cæsarean section has not been so satisfactory as to warrant its present frequent performance. Capable obstetricians such as Blacker, Hitschmann, and Williams report a mortality of less than 3 per cent by established methods other than section, and in view of the fact that the fetal mortality will be high in any event, owing to prematurity and the complications incident to low placental implantation, abdominal section should be reserved for the exceptional case and should not be the routine treatment of election.

Perhaps the greatest abuse of the cæsarean operation has been in the treatment of eclampsia. Many surgeons still advocate it almost as a routine treatment, in the face of the fact that the maternal and fetal mortality is still above 30 per cent, and that competent obstetricians are reporting results by palliative measures never equalled by the advocates of abdominal delivery. Its occasional employment in eclampsia is amply justified, but its routine application is a sad commentary in the light of available statistics.

When we read of the employment of cæsarean section for various malpresentations—in Holland's recent review its employment for impacted shoulder produced a maternal and fetal mortality of 50 per cent—hydramnios, hydrocephalus, primary uterine inertia, asthma, varicose veins, and epilepsy, we can form a just estimate of its widespread abuse. We have no idea of condemning the operation when it is indicated and properly performed. We have presented the subject merely to point out the need of a campaign of education to correct the impression of its safety, to define more clearly the indications and complications, and to attempt to standardize a useful operation which is being indiscriminately employed without a proper knowledge of fundamental obstetric principles.

C. Jeff Miller.

THE OPERATIVE RISK IN CASES IN WHICH THE FLUID IN THE COMMON DUCT IS COLORLESS

THE term "white bile," which is a misnomer, is applied to the colorless liquid occasionally found in the obstructed common and hepatic ducts.

The factors incident to the production of white bile have been a matter of conjecture, although Rous and McMaster, in 1921, were able to prove experimentally that it is a secretion of the mucosa of the biliary passages, and occurs in obstructed ducts which are not connected with a functioning gall bladder, that is, a gall bladder which is concentrating its contents by absorption. In several animals obstruction of the common duct was produced in such a way that the gall bladder still communicated with the channels in stasis; in these instances, it was observed that the bile was heavily pigmented and syrupy, ropy, or tarry, according to whether the period of obstruction had been long or short. In several dogs, cats, and monkeys, the common duct and the neck of the gall bladder were obstructed, or one or more of the large hepatic ducts were tied and cut separately. The stasis fluid in these cases was at first brown, then green, but definitely less pigmented, and finally after 10 or more days of stasis, became clear and often completely colorless. In several dogs a portion of the common duct was isolated by ligating and cutting it above and below. At various periods up to 12 days, this isolated segment was examined and found uninflamed, but greatly distended in every case, and it contained colorless, watery, or mucinous fluid. All of the animals became jaundiced, but none of the duct fluid was bile-stained, and cultures of this fluid were negative.

Berg, in 1922, in his monograph on the biliary system, expressed the opinion that white bile must be due to some cause other than obstruction as, in a large number of cases, a similar obstruction produces dark, concentrated bile. This, however, does not contradict the deductions made by Rous and McMaster, since the function of the gall bladder in Berg's obstructed cases apparently was not taken into consideration.

Kausch, in 1911, reported a case of white bile in which he operated, and 13 cases collected from the literature. He believes that white bile is a secretion of the mucosa of the biliary passages which collects as a result of obstruction, when the secretion of the mucosa of these passages is greater than can be resorbed. He says that when a certain pressure is reached in the bile ducts, the direction of the flow in the liver is reversed, that is, the bile formed by the liver cells and the bile in the passages pass into the lymphatics and blood vessels. As a result of this and the continued secretion of the colorless fluid by the mucosa of the biliary passages, the liquid in these passages becomes lighter and lighter, and finally colorless. In none of these 14 cases was the obstruction due to stone, and Kausch believes it unlikely that obstruction by stone would result in white bile.

A study of the patients with this condition who have come to the Mayo Clinic seems to bear out the conclusions of Rous and McMaster, based on their experiments on animals. There were 19 cases of white bile among 649 operations on the common and hepatic ducts during the past few years. In 9 of these the obstruction was due to stone in the common or hepatic duct, and in 6 to trauma at a previous operation; in 2 the obstruction was due to carcinoma (one of the pancreas and one of the ampulla); and in 1 it was due to pancreatitis. In one instance the white bile seemed a result of cholangeitis. In every instance in which

the gall bladder was present, it was apparently functionless as a result of inflammation.

As might be expected, jaundice was a more or less constant manifestation. It is not known how quickly the contents of the common and hepatic ducts become colorless. In this series of cases, the shortest period of continuous jaundice before operation was 2 weeks; the longest period was 1 year, the average duration 16 weeks. Seventeen of the 19 patients were intensely jaundiced at the time of operation and there had been no recent decrease. One of the patients who was not jaundiced had a biliary fistula; another was not jaundiced, although the common duct was completely obstructed by stone. In the latter, choledochotomy with removal of stone, and cholecystectomy resulted in drainage of bile on the fourth day, but the patient died on the thirty-second day after operation from acute hæmorrhagic pancreatitis.

One of the cases was rather unusual. The gall bladder contained green, watery material, while the common duct contained fluid without a trace of bile pigment. This patient had been having gall-stone colic at intervals for a year, but had been jaundiced only 2 weeks. At operation marked cholecystitis was found. The common duct was twice normal size, and the glands along the ducts were greatly enlarged. The gall bladder had been cut off by an inflammatory process, and the contents of the biliary passages became colorless before hydrops of the gall bladder could be produced. Cholecystectomy and choledochotomy were performed, and at the close of the operation the drainage was bile-stained. As a rule, bile appears in the ducts in a remarkably short time after drainage is established. In this series bile appeared in the first 24 hours in all but 1 case; in this case, no bile drained until the fourth day. In several cases, the common duct contained only colorless fluid, but by the time the operation was completed the drainage was bile-stained.

It cannot always be assumed that white bile in the ducts indicates that the liver has ceased to function. In only 1 of the 19 cases, the liver was probably not secreting bile. There are two definite reasons for believing that the liver does not necessarily cease to secrete bile: first, the elimination of bile in the urine would result in a decrease in the jaundice; second, if the liver had ceased to secrete bile, it would hardly resume that function so readily after drainage is established. It is well known to surgeons that if bile does not appear soon after the establishment of drainage of the common duct, in deeply jaundiced patients, the outlook is not favorable. In two of our cases which did not recover, there was only very slight drainage for a few days, and then it ceased entirely.

The presence of a colorless liquid (without bile pigment) in obstructed common and hepatic ducts, undoubtedly indicates a serious operative risk even with cautious pre-operative measures and postoperative care, including calcium, transfusions, and so forth, as the mortality in this series was high. It is believed that while the mortality is high, it probably is no higher than it would be in a series of cases of complete biliary obstruction of the same duration with green bile in the common and hepatic ducts. Cases presenting white or colorless fluid in the ducts are not necessarily doomed, as this finding does not mean that the liver is interfered with more than in any deeply jaundiced patient. The colorless fluid, or so-called white bile, is a product of the glands of the duct wall. It is secreted under sufficient pressure to continue to form, regardless of the secretion of bile from the liver, and it collects in the ducts only when the activities of the gall bladder are destroyed.

E. Starr Judd.

MASTER SURGEONS OF AMERICA

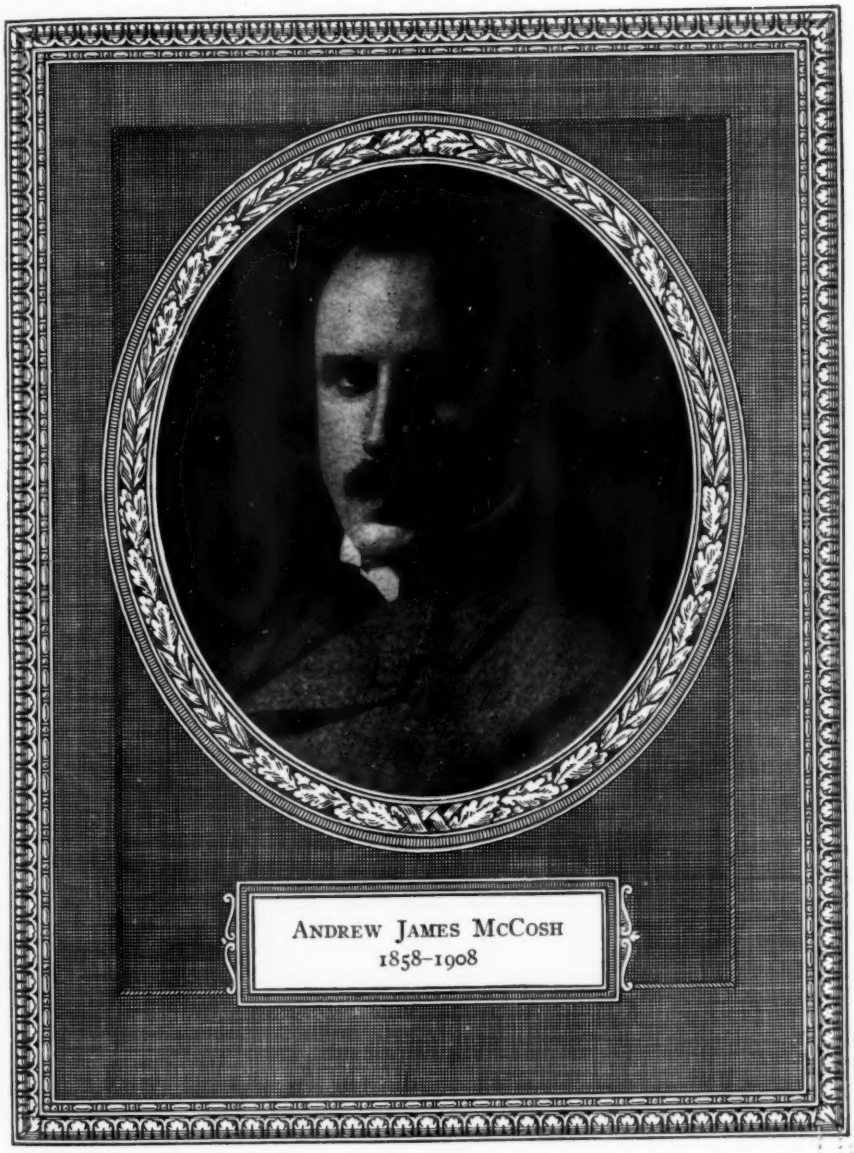
ANDREW JAMES McCOSH

DR. ANDREW JAMES McCOSH was one of the best loved surgeons who has ever honored the medical profession of New York. He made a very deep impression upon the thoughts and hearts of his contemporaries, and he died without an enemy. He was a Man! No one was born with a more compelling personality than Dr. McCosh. His Scotch ancestry dominated in that he inherited those sterling qualities of perseverance, and noble ideals; he never lost his "canniness" nor his broad Scotch accent.

On his mother's side he was the grandson of Dr. Alexander Guthrie, for many years a prominent surgeon of Edinburgh. His mother was the saintly Isabella Guthrie McCosh, who, long after her husband's death, was the Angel to many a Princeton lad in illness and distress. His father was Dr. James McCosh, the president of Princeton University, who, though a conspicuous Scotch divine, fought valiently for the doctrine of evolution.

Dr. Andrew McCosh was born in Belfast in 1858 and came to this country in 1868, when his father was called to Princeton as president of the University, then the College of New Jersey. Here he grew up and prepared for college, from which he was graduated with honor in 1877, receiving an A.B. degree. That he was an active, mischievous undergraduate is instanced by the fact that he, together with some sophomores, robbed his august father's hen roost, for which he was soundly thrashed. He was very athletic, being on the football teams of 1874, 1875, and 1876, and captain the last year. His superb physical development stood him in great stead later, for he was tireless in the exertions incident upon a large hospital and private, surgical practice. He was an honor man in junior year and delivered the Modern Language Honorary Oration at Commencement. In 1880 he received an A.M. degree at Princeton.

He studied medicine at the College of Physicians and Surgeons in New York, receiving his M.D. degree in 1880, being one of the ten honor men of his class of 160 members. During his interneship of one and a-half years in the Chambers Street Hospital, he was afforded unusual opportunities for active, accident, and surgical service. After a year in post-graduate study at the University of Vienna under Billroth, at that time the greatest surgeon in Europe, he started practice in New York City, in 1883, associating himself with Dr. T. Gaillard Thomas, at



ANDREW JAMES MCCOSH
1858–1908

that time the most prominent gynecologist in New York. This association lasted for 11 years. The temptation for him to specialize in gynecology must have been very strong, but Dr. McCosh's training on broad, general surgical lines had been too great to cause him to limit himself to any specialty. His best work was done in gynecology, yet he is not known as a gynecologist; his activities concerned themselves with all the problems of general surgery.

In 1887 he was made an attending surgeon to the Presbyterian Hospital, New York City, which position he held until his death. There he held his clinics, first, as professor of clinical surgery in the New York Polyclinic until 1895, after which he became clinical professor of surgery at the College of Physicians and Surgeons. From 1903 until his death, he was president of the Medical Board of the Presbyterian Hospital. For 2 years he was president of the New York Surgical Society. In 1904, in recognition of his work, Columbia University conferred upon him the honorary degree of doctor of laws, and in 1906 Princeton gave him the same degree. In the American Surgical Association, in the New York Academy of Medicine, and in the Clinical and Practitioners Societies, his papers and discussions were listened to with great interest and respect.

In appraising a man like Dr. McCosh, two characteristics must be considered; first, personality, and second, professional ability. His personality was characterized by charm to the highest degree, and his rugged, outspoken opinions, which won for him lifelong friends, were given in so tactful a way that offense was never created. He was a man of decided opinions, yet he never had an enemy. This was due in a large measure to his inherent honesty and straightforwardness. He never became entangled in medical politics.

Dr. McCosh spent his summers in travelling in Europe; in consequence, he was an intelligent, well-rounded, thoughtful man of affairs. Perhaps his noblest quality was his kindliness. The last thing he thought of was money and his benefactions were innumerable. Frequently a patient, who had met with reverses, would be sent into a private room with the understanding that it was free, while Dr. McCosh would himself pay for the room and the special nurses.

His intuitions were extraordinary, and this, combined with perfect poise and entire absence of irritability, made him master of all trying situations. Doctors associated for years with Dr. McCosh never saw him angry nor ever heard him use a profane word even in the most trying circumstances.

His modesty was phenomenal and very unusual. He never pushed himself forward. When he made an address at a surgical meeting, his remarks were brief, concise, and pregnant, and his admirers felt that he rarely did himself full justice in public. To the poor he was always a dear friend; no one in any kind of trouble ever appealed to him in vain. He avoided heated arguments and discussions, and was conciliatory without any trace of weakness. He was saved from embarrassing entanglements by his superlative intuitions.

His interest in the young men of the hospital staff was very keen. During the last year of his life, he made a practice of having the entire staff of the hospital, both medical and surgical, gather at his house, one evening a month, for social intercourse and an informal conference on medical topics.

In his surgical judgment he was unsurpassed. As a result of his large experience, he intuitively arrived at a quick decision without going through the conscious deductions and reasonings which most surgeons employ. For this reason he was not a very good instructor. His decisions often seemed uncanny. As an operator he was speedy, skillful, and precise. His cordial appreciation of the work and merits of those about him won for him the love and devotion of all. He was always encouraging, and never spoke harshly to anyone who he thought was really doing his best.

From 1889 to 1908, he published many important articles in the surgical journals. In collaboration with Professor M. Allen Starr, he became an expert brain and spinal cord surgeon, and he wrote a number of papers on these subjects. His address before the Congress of American Physicians and Surgeons in Washington in 1897, and that before the International Congress of Surgery in Brussels in 1905, both on the subject of "Peritonitis," won for him world-wide fame. In the surgery of the female pelvis, he was unsurpassed, and his early papers advocated the advisability of performing a myomectomy instead of a hysterectomy in women in the child-bearing period, and he cited numerous patients who had borne full term, living babies after myomectomy. He always left healthy ovaries and tubes after hysterectomy for fibroids. He did not remove a healthy uterus after ablating the adnexa for purulent infections. The present day gynecologist has not improved upon the procedures of Dr. McCosh. His papers upon appendicitis, gall-stones, epilepsy, brain tumors, spinal surgery, exophthalmic goiter attracted wide attention and were translated into several foreign languages. He was a very versatile surgeon, as were all the "Master Surgeons" of those days.

Two of Dr. McCosh's aphorisms have remained unforgotten by his protégés:

1. Teach your patients to get along without medicines.
2. Never divide a fee with a doctor.

On December 2, 1908, at the age of fifty, in the fullness of his skill and development, Dr. McCosh died from a fracture of the base of the skull sustained in a runaway accident, and thus to his reward passed one of America's greatest surgeons. In the words of Professor M. Allen Starr: "If it is the greatest reward of a surgeon to advance his science, to secure the admiration, respect and love of his associates, to win the devotion of his grateful patients, poor and rich, and to be cherished in the hearts of all who knew him, Dr. McCosh certainly received his reward."

CLARENCE A. MCWILLIAMS.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD JANUARY 5, 1923, WITH DR. FREDERICK G. DYAS, PRESIDING

DR. P. B. MAGNUSON read a paper entitled "Present Status of Arthroplasty, Especially in the Knee Joint."

LONGITUDINAL OVERGROWTH OF LONG BONES

DR. KELLOGG SPEED read a paper entitled "Longitudinal Overgrowth of Long Bones." (See p. 787)

DISCUSSION

DR. DAVID C. STRAUS: The first case, reported by Dr. Speed, does not seem to me to be conclusive. In this case, where he did a subperiosteal resection, the cambium layer was left attached to the periosteum, and extension was applied. The periosteum with the cambium layer was stretched with regeneration of bone.

The last three cases he reported are much more interesting. It seems to me these three cases have some common explanation. In the last case the injury was essentially in the knee joint and the nutrient artery of both the femur and the tibia are directed away from the knee joint, and as we know that the epiphysis toward which the nutrient artery is directed is the first to unite and that the epiphysis from which the nutrient artery is directed is the last to unite and that consequently growth continues longer from this epiphysis, we know that normally growth continues longer in the femur and the tibia from the epiphyses near the knee. In the other two cases where the longitudinal overgrowth was in the leg, the osteomyelitis of the tibia was extensive involving the whole length of the diaphysis, so that the inflammatory reaction reached the epiphysis near the knee.

When Dr. Speed was reading the first part of his paper it recalled to my mind a roentgenogram I saw when I was at Vienna in Holzknecht's Clinic. The case was one of tuberculosis of the wrist joint in a child. Both forearms and wrists had been taken on the same plate for comparison. The carpal bones were only partially formed, but growth was much more advanced in the carpal bones on the diseased side, and the distal ends of the bones of the forearm also showed an increase in growth in the forearm in which the wrist was diseased. Holzknecht explained the increase in growth on the diseased side on the basis of hyperæmia causing the increase in the rate of growth. This same fact may explain the last three cases that were shown by Dr. Speed.

DR. VERNON C. DAVID: One interesting thing about overgrowth of bones is the compensatory overgrowth which takes place in children in fractures of the femur. I do not know how widely that has been observed. I was ignorant of the fact that quite a marked compensatory overgrowth of the femur takes place after a fracture of the femur in children where considerable shortening has occurred on one side.

During the last 2 years I have been able to follow a fairly large series of fracture of the femur in children in which we have seen in the course of 9 months or a year that the injured leg had increased in length at least half an inch as compared with the measurement taken directly after union had occurred. This is a very happy circumstance. Of course, the prognosis in these cases of fracture of the femur in children, where some shortening has occurred in spite of management, is very good.

Dr. Speed quoted from Bruns as having observed this in six cases. I have seen it occur in more than six cases, and perhaps it is a commonly observed fact.

DR. GOLDER L. MCWHORTER: I am interested in the apparent growth of the fibula as illustrated, especially in the case in which the gross specimen is being passed around. Apparently it has grown in length along with the tibia and, therefore, must be longer than the fibula on the other side. We can explain the overgrowth of the bone in which the inflammatory lesion is situated, since it occurs in other conditions besides osteomyelitis, such as tuberculosis, where the long bones are described as being lengthened, by various authorities in the literature.

I would like the essayist to explain what he thinks is the cause of the overgrowth of the fibula in these cases in which the stimulating lesion is in an associated long bone.

I had a case several years ago, which I described in the *Surgical Clinics of Chicago*, where there was a measurable increase of about an inch and one-half, in the length of both the tibia and fibula, but I did not get a roentgenogram of it. This patient had an osteomyelitis of the tibia as a child with abscess formation as evidenced by the history and a scar. He came to the clinic complaining of symptoms in the sacro-iliac region, which I thought were due to the tilting of the pelvis by the longer leg.

From looking at the roentgenograms of the other two leg cases shown, the fibula did not seem to have

grown equally in length with the tibia, although it appeared longer than the normal. As was pointed out in the roentgenogram concerning the last case reported by the essayist, the fibula appeared farther from the knee joint than normally. In the specimen being passed around, the head of the fibula is close to the knee joint and the fibula unquestionably took part in the overgrowth in length as well as the tibia.

DR. FRANK PIERCE: With regard to the fibula, those who have studied the plates in these cases will see that the fibula shows an increase in length the same as the tibia. They are longer than the fibula on the opposite side. Many such overgrowths are found in the leg.

We know that in many cases of delayed union in fractures, weight bearing and irritation will cause the fracture to unite. I believe that to a considerable extent ossification at the epiphyseal line will occur earlier as a result of weight bearing than in cases of diseased bone or normal bone upon which no weight is borne for some years, and that the lack of weight bearing in these cases contributes largely to their overgrowth.

DR. D. B. PHEMISTER: It is well known that a chronic inflammatory process in an extremity may produce lengthening of a bone even when it is situated in another structure. In chronic osteomyelitis of the femur, the tibia and fibula on the affected side may be considerably longer than on the unaffected side. No doubt the long standing hyperæmia of the extremety is definitely related to this bony overgrowth.

DR. DANIEL N. EISENDRATH: An interesting point in relation to chronic infection of bone takes place in the kidney. Quite a few cases have been described of bone formation in chronic suppurative conditions of the kidney and show what Dr. Speed has brought out, that under the influence of chronic infection in osteomyelitis through some metabolic disturbance, bone formation takes place in organs where we would not expect to see it otherwise.

DR. SPEED (closing): I do not think Dr. Straus' point is very well taken because in the innumerable injuries of joints, especially in the epiphyseal region around the knee joint, we have not frequently found the overgrowth. The injuries must be very common, but the overgrowths are not very common. If I have seen three cases, there must be 300 lying around the city not noticed, because we do not look for them. Overgrowth does follow fractures of the femur in children, and I have seen at least 20 cases. Nature does make up shortening in children, and the bone simply responds to weight shortening and other stresses in accordance with Wolfe's law of the growth of bone.

In answer to Dr. McWhorter's question, I do not know why the fibula overgrew, except it was dragged along with the tibia.

DR. E. WYLLYS ANDREWS read a paper entitled "Technical Problems in Stomach Surgery."

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

THREE recently published volumes[1,2,3] on the subject of the thyroid gland reflect the particular interest that it presents to the surgeon.

Dr. Hertzler's monograph on diseases of the thyroid gland presents three particularly commendable features—a number of clear-cut illustrations of the gross and microscopic changes in thyroid disease, a well illustrated section describing the anatomy of the thyroid and the technique of operation, and a carefully written chapter by Dr. Victor Chesky on the hospital management of goiter cases.

The author states in his preface, "This study of clinical symptoms and pathological specimens has brought convincing evidence that the activity of the interstitial cells is associated with a definite clinical type of thyroid intoxication." In discussing the pathological changes in goiter he describes an increase of the interstitial cells as constantly present in some part of the gland in colloid goiter, and as dominating the picture in individual instances. He has often found in both "glandular" and "papillary" types (the former referring to the microscopic picture seen in toxic goiter without eye signs, the latter to that seen in exophthalmic goiter) a diffuse infiltration of interstitial cells. Finally, he has found in cases termed "formes frustes" a marked increase in interstitial cells, and suggests the possibility that these cells represent one component of what is actually a compound gland. The fact that these cells are constantly present in colloid goiter, that they are often found in both types of toxic goiter, and that they are markedly increased in that type of case in which there is a reasonable doubt as to the causative part played by the thyroid gland, make it difficult to correlate the presence of interstitial cells with a definite type of thyroid intoxication.

With reference to the diagnostic value of a determination of the basal metabolic rate the author states, "I have seen a number of discharged soldiers with the diagnosis of irritable heart or some such diagnosis when the patient was typical Basedow, eyes hanging on their faces, eye signs, tremor, tachycardia, goiter, and whose goiter after operation showed the typical histological changes. Because there was no notable increase in metabolic rate, thyrotoxicosis was declared to be absent."

To take out one lobe only, as the author suggests, in cases showing definite thyroid toxæmia, or to leave behind, in such cases, thyroid tissue as large as a normal lobe, would seem an almost certain way of inviting failure. With a toxic gland, the object of surgical treatment is to rid the body of the substance producing the toxic material, and to leave only a sufficient amount of thyroid to supply the body needs. The constantly improving results in the surgical treatment of thyroid disease have been definitely associated with the more general adoption of subtotal thyroidectomy as the treatment of choice.

An interesting collection of papers from the clinic of Dr. Crile and his associates reflects the successful methods with which the problem of goiter is being attacked in Cleveland. The outstanding impression which one gains from reading them concerns the infinite care and attention to detail that have been devised and employed to lessen the risk of operation for goiter, and to protect the patient before and after operation.

The most interesting chapters to us were those entitled, "The Value of Basal Metabolic Studies in Goiter," by Chester D. Christie; "The Prevention of Simple Goiter in Man," by O. P. Kimball; a short chapter on "Pre-operative Management of Exophthalmic Goiter," by W. R. Goff and E. O. Rushing; and a chapter on "The Postoperative Treatment of the Exophthalmic Goiter Patient," by Frank S. Gibson.

One statement by Dr. Christie is of particular interest, as contrasted with the idea of Dr. Hertzler, quoted above, concerning the value of the basal metabolic rate determination. "It seems certain that an increase in basal metabolism represents the fundamental and basic symptom of exophthalmic goiter, just as a hyperglycemia represents the basic symptom of diabetes mellitus."

The second edition of Crotti's *Thyroid and Thymus* is a worthy example of the best American book making. It is attractively bound, well printed on glazed paper, and illustrated with numerous clear half-tones and beautifully colored plates. It is practically an encyclopedia on the subject of the thyroid and thymus, so completely does it review the experimental and clinical work that has been done on these subjects. In addition, it

[1] DISEASES OF THE THYROID GLAND. By Arthur E. Hertzler, M.D., F.A.C.S. With Chapter on Hospital Management of Goiter Patients by Victor E. Chesky, A.B., M.D. St. Louis: C. V. Mosby Co., 1922.

[2] THE THYROID GLAND; CLINICS OF GEORGE W. CRILE AND ASSOCIATES. Edited by Amy F. Rowland. Philadelphia and London: W. B. Saunders Co., 1922.

[3] THE THYROID AND THE THYMUS. By André Crotti, M.D., F.A.C.S., LL.D. Philadelphia and New York: Lea & Febiger, 1922.

contains an exhaustive bibliography of the voluminous literature.

The chapters devoted to the operative treatment of thyroid disease are particularly well written, and well illustrated. The technique of operation in different types of goiter, the pitfalls and dangers that await the surgeon, and the method of meeting various complications that arise, are clearly described, with appropriate illustrations.

In view of its excellence and completeness it may seem ungrateful for the reader to mention shortcomings that occur to him. He is impressed, however, with the fact that so much space is devoted to the mediæval history of the thyroid, and so little to the modern. Very little space is devoted to the subject of basal metabolism with reference to thyroid disease, very little to radiotherapy, none to radium therapy. On the other hand considerable space is devoted to serum therapy, gland grafting, and experimental work that is chiefly of historical interest.

Hertzler states in his book that the history of a goiter patient ends only at his death. He leaves one with a distinctly somber impression as to the ultimate results of treatment of thyroid disease. We had hoped to find in Crotti's work the answer to this statement, but aside from statistics as to the immediate postoperative mortality there is little information concerning the late results of surgical treatment.

S. L. Koch.

CORRESPONDENCE

ABDOMINAL CORSET

To the Editor: I wish to call the attention of your readers to the advantages of a simple abdominal corset that we have used in this hospital for many years with great satisfaction.

The corset consists essentially of two strips of rather heavy cardboard cut 1¼ inch wide and from 6 to 8 or even 10 inches long, according to the size of the patient. Into these strips of cardboard I have a shoemaker set a row of shoe hooks spaced about 1½ inches apart. The nurses then cover the strips of cardboard with sheets of adhesive plaster eaving the muslin on the plaster except where it covers the cardboard until it is applied. The plaster strips are cut as wide as the cardboard is long, and the plaster from 8 to 12 inches long.

As soon as the laparotomy dressing is applied to the wound, the muslin is peeled off the plaster and the two strips of plaster applied evenly and firmly to the patient's abdomen leaving a space of perhaps 1 to 2 inches in the median line which will be taken up by the lacing. A narrow tape or corset lacing is then applied and the two strips of plaster laced evenly and firmly together. To inspect the wound or change the dressing it is only necessary to unlace the corset.

This is the most comfortable and satisfactory abdominal dressing I have ever seen. It also makes an admirable obstetric binder.

J. G. Henry, M.D.

Winchendon, Mass.

INTERPOSITION OPERATION FOR UTERINE PROLAPSE

A Correction

To the Editor: There is an omission of some considerable importance, presumably due an oversight on my part, in my note on the above subject, which appeared in the January, 1923, issue of Surgery, Gynecology and Obstetrics, p. 119. After mentioning the results that we can properly expect to follow the interposition operation, I go on to refer to what we cannot expect it to do in the following words: "But it (the interposition operation) may not be expected to offer a barrier to the descent of the cervix, once the body has begun to atrophy, or when it is already atrophied." To this sentence should be added the words—"or when the utero-sacral ligaments are lengthened." The necessity for this addition is obvious from the rest of the note, but it is well to emphasize the point.

Henry Jellett.

Christchurch, N. Z.
(Formerly Master, Rotunda Hospital, Dublin.)

AMERICAN COLLEGE OF SURGEONS

A VISIT TO THE SURGEONS OF LATIN AMERICA

I. The Foreword

By FRANKLIN H. MARTIN, M.D., F.A.C.S., Chicago

1. INTRODUCTION

THE sailing on the *S. S. Vandyck* from New York on February 10 of two hundred and seventy-five citizens of Canada and the United States, including Fellows of the American College of Surgeons and members of their families, for a cruise to Central and South American countries, was not merely the carrying out of a plan for a winter pleasure trip, but it was the culmination of a well-thought-out program to obtain a closer affiliation between the surgeons of North and South America, and to strengthen the foundations of a strong continental union through Fellowship in the American College of Surgeons.

The first step of this program was accomplished in the winter of 1920, when Dr. William J. Mayo and the writer visited the surgeons of Panama, Peru, Chile, Argentina, and Uruguay, and was pursued in the winter of 1921, at which time Dr. Thomas J. Watkins and the writer revisited these countries, adding to the itinerary Rio de Janeiro and São Paulo in Brazil.

In the meantime we had been generously received, and strong friendships had been created. More than one hundred of the leading surgeons of Latin American countries had become Fellows of the American College of Surgeons, and a large number of these southern surgeons had reciprocated by visiting us in the United States and Canada.

The story of our previous visits and the friendships we had been creating had deeply interested not only the members of the medical profession of our countries, but as well the men of broad vision in our State Department whose principal object it is to maintain a sympathetic friendship between the Governments.

2. THE START

And so, on the tenth of February, at twelve o'clock noon, we had gathered on the snow-covered deck of the *S. S. Vandyck*, our chartered ship, and amid snow-balling, still and motion picture taking, rejoicing and good-byes, we departed from our friends who stood on the dock. We slowly made our way as we reviewed the panorama of the shore line of a great city of the world, gave a farewell salute to the Goddess of Liberty, said adieu to zero weather and snow-storms, and sailed on to summer seas and tropical charm.

3. OUR CARGO

Fellows of the American College of Surgeons and members of their families and friends, bringing the number up to two hundred and seventy-five, comprised the bulk of the cargo. In addition we carried ballast of through freight and food and water supply. The College had representatives from thirty-five states of the United States and five provinces of Canada. Of these, eleven were Founders of the College, nine Governors, one Regent, and Dr. John George MacDougall, vice-president, and acting president for the period of the cruise.

4. THE SHIP

The *S. S. Vandyck*, with a displacement of 21,000 tons, the largest, newest, and most luxurious of the Lamport and Holt Line steamers, with her competent and genial Captain, John Byrne, whose character possesses the best the name implies, to guide her maritime destinies, furnished us a palatial floating hotel which, stripped of second-class and third-class passengers, afforded not only most satisfactory living quarters, but an abundance of deck space for exercise and desirable seclusion.

The aft lounge, ordinarily used for second-cabin passengers, was converted into a commodious meeting place for medical and popular gatherings. With its stereopticon lantern accommodations, it was available day or night, and furnished a delightful place for discussions of all kinds. The aft smoking-room, too, was an exclusive resort for card games and social confab. The main lounge,

music-room, and smoking-room contained the usual luxurious accommodations for the more conventionally inclined. An out-of-door swimming tank of generous capacity on the aft deck was an everlasting source of refreshment and exercise for young and old. The cabin service and the dining-room service were well organized, and offered the very best that a well regulated ship sailing under the British flag could furnish.

5. OUR MISSION

Among the many objects of our mission, which was abundantly fulfilled in actual accomplishments as we pursued our journey, were recreation in a tropical atmosphere far removed from the winter climate; social intercourse with our Latin American neighbors; an observation of their methods of practicing medicine and surgery; visits to their institutions of learning, especially their medical schools; a study of their hospitals and their method of organization; intimate contact with the members of the surgical profession working in their accustomed environment; and enjoyment of the hospitality of their cities, their governments, their clubs, and their places of amusement.

6. HIGH SPOTS OF OUR EXPERIENCE

The lover of the sea could conceive of no greater degree of pleasure than the ocean voyage from a New York port in February, south to Havana and Panama, east to Colombia, Venezuela, and Trinidad, past the mouth of the Amazon, across the Equator, east around the great bend, diagonally west again to Rio de Janeiro, south to Santos, Montevideo, and Buenos Aires, and then, after much sightseeing and many happy experiences, returning with a few stops to the starting point. It is a succession of balmy seas, undisturbed by storms, and an experience of restfulness that cannot, I am sure, be excelled.

7. HAVANA

At Havana our committee was met by a group from shore, immediately upon lowering our gangplank, consisting of a reception committee from our own Embassy, an official representative of the Government, and the Fellows of the College in Cuba. First was our genial and strenuous Major General Enoch H. Crowder, who within the hour had received almost simultaneously notices from the State Department and the War Department of Washington announcing, first, his appointment as Ambassador to Cuba (a newly created position), and, second, his retirement as Major General of the United States Army. Next our sympathetic Dr. José E. Casuso, and Dr. José A. Presno y Bastiony, both Honorary Fellows of the College, with their confrères, and the representatives of the president of the Republic, Señor Dr. Alfredo Zayas. Following the formal greetings and the necessary photographing by an enterprising group of journalists, our party was informed that the President was to receive us at four o'clock in the afternoon, and the other details of our day's program were arranged.

At the Seville Hotel, where practically all members of our party lunched, Ambassador Crowder and his staff were our personal guests. In the midst of the luncheon I announced the new honors that had come to our great friend, General Crowder, and the enthusiastic applause he received brought him forward to make his first speech as United States Ambassador to Cuba. Following his talk, the luncheon was almost forgotten because of an impromptu reception line that was immediately formed by our people who wished to shake the hand of the man who had so successfully organized the Selective Service Draft for the Great War. It was a great event for us, and obviously pleased the new Ambassador.

At four o'clock Ambassador Crowder appeared and led the procession that proceeded two by two on foot from the hotel to the President's palace, two blocks distant. Our long line of people, headed by the man who has become a great friend to Cuba, attracted the attention of the many pedestrians on the streets. On arrival at the palace, we were received by the President and his Señora, who were assisted by the officials of our party and Ambassador Crowder.

Several interesting drives about Havana were provided for the sightseers, and a number of private luncheons and dinners entertained special friends.

8. PANAMA

It is always an inspiration to any traveler, and much more to a citizen of the United States, to approach Panama and slowly to make the landing at Colon. There is the fascinating beauty of the shore line, with its projections, its islands, and its bays, with its wealth of billowy green foliage, out of which peep red-roofed structures made by man and stalwart palms,—and to all of this is added the romance of history, the early landing of Columbus, the surprise of the enterprising Balboa, the sport of pirates, the early adventures of the Spaniards, the struggle against pestilence and disease, the enterprise of de Lesseps, and the final triumph of sanitation and engineering in overcoming the ruthlessness of the tropics and bringing forth a princely paradise.

Our friends of old were at the dock to meet us, to greet us, and to guide us. Our party proceeded across the Isthmus to Balboa and Panama by relays of railroad and ship to inspect the Canal. At Panama a program had been planned which had for its principal feature the laying of the corner-stone of the Gorgas Memorial Institute of Tropical and Preventive Medicine. As the acting president of the Gorgas Memorial Institute, I had been requested by marconigram the day before to respond to the address to be delivered on this occasion by President Belisario Porras. On the beautiful site presented to the Gorgas Memorial Institute by the Republic of Panama an open pavilion had been erected to accommodate the speakers, the Government officials, and the distinguished guests. An audience of many hundreds had assembled, and on our arrival we proceeded to the pavilion through a narrow lane that was kept open by soldiers. A large band enlivened the scene with its music. An address was made by President Porras, whose delivery was that of a trained, impassionate orator, and he was received with great enthusiasm. He was followed by Dr. Augusto S. Boyd, who delivered an address of welcome to the English-speaking strangers, and a short response by myself. President Porras then, assisted by the other members of his committee and the writer, secured with trowel and mortar an appropriate tablet on the site of the future home of the Gorgas Memorial Institute. It was an inspiring occasion. At our right as we spoke was an heroic plaster bust of General Gorgas, and its life-like features, with the genial smile playing about its face, encouraged us who loved him to believe that he was there in spirit to lend approbation to our action.

The site selected for carrying on the work of Gorgas is located on a point of land which projects into the Bay of Panama, and commands a view of the heights of Balboa, Ancon Hospital, and the far-away hills and mountains bordering the Canal; it lies in close proximity to the new Santo Tomas Hospital which is partially finished, all occupying a generous tract of land on the old exposition grounds.

In the evening President Porras gave a formal reception at the Executive Mansion to which all members of our party were invited, as well as the society of Panama and the Canal Zone. It was a brilliant affair, combining cordiality of the highest type and an oriental display of hospitality that is seldom seen in these days of somber lights, and it warmed the hearts of the most stolid.

During the reception, an Honorary Fellowship in the College was conferred on Dr. Augusto S. Boyd, a distinguished surgeon of Panama, by the officials of the American College of Surgeons.

The President is not only a beloved executive and a man of strong personality and culture, but he has within him the power to impart enthusiasm to his associates and the quality the Spaniards express as "sympatico." It may be said, without danger of refutation, that he succeeded in making a friend of every member of the American College of Surgeons who visited Panama; and as to their wives, they are still inquiring when we shall go back to beautiful Panama and to their friend, President Porras.

9. COLOMBIA

Cartagena, Colombia, was our next stopping place, and that most ancient of all cities of the western hemisphere, with its protecting wall still in good repair, gave us a glimpse of the civilization of this most northwesterly Republic of South America. A drive about the city, a visit to the Governor, Señor Doctor Roman, a survey of their large municipal hospital, luncheon in the out-of-door pavilion of the Club La Popa, and a tea dance at their seashore club, Miramar, created an atmosphere that was enjoyable, interesting, and never to be forgotten. Colombia has four Fellows of the American College of Surgeons, three of whom live in the interior, at the capital, Bogotá. Special envoys from there, and officials of the medical societies of Colombia, called on us and presented the compliments of the medical men of the Republic. Dr. Rafael Calvo, C., of Cartagena, our host of the day, and one of the distinguished surgeons of the country, welcomed us with true hospitality. In the evening we conveyed him to our ship, and in the presence of members of his family, the Governor and other guests, Dr. MacDougall conferred upon him an Honorary Fellowship in the College.

10. VENEZUELA

We called at La Guayra, the port of entry to Caracas, Venezuela, on a beautiful morning, February 23. The snug little hamlet with its small exposed harbor lay before us, and a succession of imposing shore mountains of the Sierra Nevada coast range, covered with green, rose from the beach line and were the foot-hills of a bewildering bulwark of mountain terraces which terminated far above in snow-capped peaks. Laboriously and slowly we made a landing in the ship's boats, aided by a small coast tender loaned to us in our emergency. On two trains we proceeded to Caracas, which is nestled on a plateau twenty miles away by rail, and six miles distant from the coast

as the crow flies. Among the mountains above the sea we rose and meandered around the peaks, on ledges of barren rock, through tunnels, over trestles, and enjoyed a succession of scenes of one of the famous mountain rides of the world.

On arriving at the capital, we were whisked to the official residence of the President of Venezuela, General Juan Vincente Gómez, where our party was received by him and his entire cabinet, including the wives of the President and his officials. The reception room was on one side of a beautiful patio and was an imposing hall of about seventy-five by fifty feet, with a high ceiling. The carved walls were decorated with portraits of ex-presidents and generals of the Republic, nearly all of them in military dress. The President, a strong man with a military bearing, and several of his cabinet officers were in khaki uniforms. Military guards were all about the palace; and with the uniforms, the bright colors of the decorations and the ladies' dresses, the entire scene was of unusual impressiveness. The President is an animated individual, and entered into the spirit of hospitality. He was ever ready to accommodate the ubiquitous photographers and posed for many pictures.

After the reception our party divided and the men and women lunched at separate hotels. Later the surgeons visited the hospitals, inspected the well-equipped laboratory of tropical medicine and other governmental institutions, and in all too short a time we glided down the scenic railroad to our ship in the blue waters of the bay three thousand feet below.

A committee of the Fellows of the College, headed by Dr. Luis Razetti, remained with us during the day and until we waved them adieu at twilight on the little landing in La Guayra.

11. TRINIDAD

We drew a surprise from Captain Byrne on Sunday, February 25, when he gave us a look-in at the beautiful city of Port of Spain on the island of Trinidad. As this was not on our itinerary, we were on our own, and succeeded in spending an interesting day in long country drives into the interior, examining some of the curious places, and enjoying the hospitality of the institutions and hotel. Trinidad, not unlike many of the islands of this archipelago, would make an ideal dwelling place for one who enjoys the charm of the equable climate of the tropics and an old civilization.

12. BRAZIL

Regretfully, because of loss of time, we skirted the great breast of Brazil, by the mouth of the greatest river, and down by its old cities of Bahia and Pernambuco, which we could not visit at that time, and kept our appointment in the most beautiful city of the world. We cast anchor at Rio de Janeiro on the morning of March 7 and were met by representatives of the Government, Ambassador Edwin V. Morgan, members of the medical profession and of the Brazilian exposition. They presented to us a program that they had arranged which included an audience with the President that very afternoon, a reception by the Minister of Justice at the Gloria Hotel that evening, a visit the next morning to the Oswaldo Cruz Institute of Tropical Medicine, and finally a reception at the medical school in the afternoon. In accordance with this program, President Arturo da Silva Bernardes, assisted by his officials and Ambassador Morgan, received all of our people at the Executive Mansion, and made us happy by consenting to photographs and a motion picture scene with us that will enable us to preserve a valuable record of the reception.

That evening a brilliant ball was given at the new Gloria Hotel, where in resplendent informality we were greeted by Senhor Doctor João Luiz Alves, the Minister of Justice, in a formal speech, to which I replied. Both of these talks were interpreted by a representative of the Government, Senhor Felix Pacheco, Chancellor, for those not understanding either Portuguese or English.

We danced away the evening in this beautiful ball-room, from the windows of which we could observe Sugar Loaf and the many undulations of the bay, outlined by beads of electric lights, in the center of which was emblazoned in splendor the Exposition.

Guided by that most splendid of all hosts, Carlos Chagas himself, the distinguished director of the Oswaldo Cruz Institute, a large group of our Fellows wended their way early the next day to the Institute, where we feasted on the scientific display and on the very delightful repast that he had to furnish us.

That afternoon, although a number of our party had been drawn away by the physical attractions of Rio de Janeiro, we visited the medical school. This was one of the most attractive receptions that was accorded to us. The members of the faculty were in academic dress, resplendent in color and dignity, and made us regret that we had not come in our Fellowship gowns. In the great patio of the quadrangle that represents the buildings of the college, was a large military band which regaled us with inspiring music while we visited the marvelous institution that has been so completely planned by Dr. Aloysio de Castro. Then in a brilliant convocation hall, in the pres-

ence of the students, distinguished guests, and our own people, Dr. de Castro greeted us by an address in English, to which our acting president, Dr. MacDougall, responded. Refreshments were served, and after surveying the building and classrooms, we departed, filled with admiration for their most comprehensive place of learning.

That evening the Academy of Medicine of Rio de Janeiro entertained the Fellows of the College and their wives and friends at the Exposition, and in the Palace of Festivals at 9:30 o'clock we held a formal medical meeting, attended by the members of the College in their Fellowship robes. It was a brilliant gathering. Professor Dr. Miguel Couto, president of the Academy of Medicine, presided. Dr. John Osborn Polak and Dr. F. N. G. Starr of our party, and Fellows Dr. José de Mendonça and Dr. Fernando Vaz of Rio de Janeiro, read short scientific papers. President Couto conferred upon Dr. MacDougall, our acting president, and on me as director general, Honorary Fellowships in the Academy of Medicine of Rio de Janeiro, which included the presentation of handsome medals. The American College of Surgeons conferred on Dr. Olympio da Fonseca an Honorary Fellowship.

During these two days of brilliant entertainment, many of our ladies and Fellows stole away and enjoyed the wonderful sights and interesting places of Rio de Janeiro. On Friday and Saturday of the week some of us took occasion to seek out their clinics, their hospitals, and other things of interest to the medical mind. On Friday a number of us visited Petropolis, and enjoyed a survey of this summer capital, a visit to some of our friends of old, and the acquaintance of new friends of value.

This sketch is not a book—the only thing that could even attempt to describe Rio de Janeiro. Therefore, we must remain satisfied to mention that the beauty of Rio de Janeiro was everywhere about us as we pursued our rapid pace. And here, busy showing us the high spots, were our old friends, the Fellows of the College, and always at our side, strenuous as ever, was Dr. Oscar Clark.

13. SANTOS AND SÃO PAULO

On Saturday, March 10, our party divided, about fifty traveling by railroad across country to São Paulo, the great coffee state of Brazil, and the others continuing on our ship to the port of Santos, the coffee outlet for São Paulo and the surrounding country, where we again joined our forces. Sightseeing was our principal object on this part of our trip. At São Paulo, however, our hosts of other years, members of the College and local officials, urged upon those taking the inland trip and those who would make the two-hour railroad ride from Santos in response to a hasty invitation, to partake of an elaborate and beautiful banquet which was given at the famous Automobile Club in São Paulo.

The following morning a number of our Fellows attended clinics at various hospitals, and here they were able to judge of the excellent scientific work of the surgeons of São Paulo. An invitation to attend a reception by the governor, extended through our gracious host, Dr. J. Alves de Lima, had to be regretfully declined because of the inability of all of our people to get together.

14. ARGENTINA

The three days of delightful rest on our comfortable ship, after our interesting entertainment of a week in Brazil, were very welcome, and that brought us on the morning of March 16 to the port of Buenos Aires, where we were to spend five days in sightseeing and entertainment—social and professional enjoyment. Dr. Marcelino Herrera Vegas, Dr. José Arce, Dr. Frank Pasman, Dr. Ricardo Pasman, Dr. Robert Halahan, other Fellows of the College, our Consul, a representative of Mr. John Riddle, our Ambassador, and officials of the Argentine Government were early on board to welcome us. An elaborate schedule of clinics was handed to us, one that filled our surgeons with joy. Sightseeing rides and excursions had been prepared by our official guides, Thos. Cook & Son, and with these had been interspersed official entertainment which did not conflict. The high points were a reception by Ambassador Riddle, a reception by the president of the Republic, Señor Dr. Marcelo T. de Alvear, a reception at the headquarters of the medical society, a visit to the medical school and the Department of Sanitation, and finally our Convocation at the medical school. An Honorary Fellowship was conferred upon Dr. Marcelino Herrera Vegas, and Dr. Arce, rector of the University, Dr. MacDougall, and the writer made addresses, followed by two scientific papers by Dr. James T. Case and Dr. Hugh Young. This function was held in a beautiful academic hall, and was a very brilliant affair. The one hundred odd Fellows of the College from North America wore their Fellowship gowns and occupied the center of the hall surrounding the raised platform on which were gathered the members of the Faculty of Medicine of Buenos Aires; the ladies and members of the local profession occupied places immediately back of the Fellows of the College, and a large number of medical students were massed in the aisles, the window and door spaces, and in a solid group in

the rear of the dais, forming an effective and interesting background.

There were many private entertainments which kept everybody busy, one of the most enjoyable being a luncheon given by Dr. Herrera Vegas to a large group of our ladies at the Plaza Hotel. Following this there was an excursion of Fellows and ladies to Las Hermanas, his large *estancia*.

On Wednesday morning, March 21, fifty of the members of our original excursion departed from us to return by the West Coast. The account of this portion of our cruise will be detailed by Dr. Salisbury, who accompanied the party.

15. URUGUAY

The prow of our ship was now turned homeward, although the next morning, on March 22, we docked at Montevideo for a three days' sojourn. Again we were greeted by the distinguished citizens of the metropolis of a South American Republic. The members of the College, the Dean of the Medical Faculty, representatives of the Government, of our own United States, Minister Philip and our Consul, were there to meet us. After the greeting and the inevitable camera practice that is always conspicuous in the Latin American countries, we drove to the medical school and the university.

For three days we were the recipients of a continuous round of delightful entertainment, and were given an opportunity of visiting all places of interest to members of the profession of medicine. The high points were visits to the innumerable clinics and hospitals and their medical school, a reception by the president of the Republic, Señor Dr. José Serrato, a reception and tea by our Minister, Hoffman Philip, and a formal evening medical meeting, attended by our Fellows in their College gowns and presided over by a Uruguayan Fellow of the College, Dr. Alfredo Navarro, president of the Society of Surgery of Montevideo, at which four of our Fellows—Dr. James F. Barnhill, Dr. A. J. Crowell, Dr. R. D. Kennedy, and Dr. James T. Case—presented formal scientific papers. Besides, small groups of the Fellows and their ladies interested in a variety of subjects were entertained by our hospitable hosts at luncheons and dinners.

Montevideo, since our first presentation of the ideals of the American College of Surgeons three years before, has been keenly interested in the College. In this smaller of the South American countries, affiliated with the College are seventeen of their leading surgeons, and the Committee on Credentials at this time unanimously recommended for Fellowship fourteen additional candidates. Two of the Fellows of the College from Montevideo, Dr. Horacio Garcia Lagos and Dr. Enrique Pouey, were in Europe at the time of our visit; and Dr. Juan Pou Orfila and Dr. Julio Bauzá, accompanied by members of their families, returned on our ship, each to spend eight months making a study tour of our clinics. They are already conversant with our language, and we hope and trust that they will return from this visit with their love for our country enhanced, and that they will come to us again and again.

16. RIO DE JANEIRO AGAIN

Rio de Janeiro, as we crept into her beautiful bay in the early morning of March 28, was again revealed to us in all of her glory. The mists and clouds had disappeared, and the shore line, the mountains, and the terraced city lay invitingly before us. A schedule of clinics greeted the insatiable surgeons, and the shops and places of beauty beckoned to the shoppers and sightseers. All of our friends were there to welcome us, and before us were two days for thorough enjoyment of this beautiful city of the world. On the second day, with the hosts impressing upon us their genuineness of friendship, our ship once more sailed forth, and we were truly on our way to our own homes in North America.

17. BARBADOS

Five days out we received a marconigram from our American Consul, Mr. John J. C. Wilson, and the medical profession of Barbados, inviting our cruise party to a reception at the Savannah Club on the afternoon of Saturday, April 7. On arriving at this interesting little British possession we were greeted on all sides by a pleasing hospitality, and the formal reception that was planned for us in advance was heartily enjoyed by us all. The shopping and sightseeing vied with our social activities, and we said good-bye with a genuine regret that we were on the last leg of a wonderful voyage. We had before us one more week of our ocean home that we had learned to love, with its congenial family, and then we began to think of home as on the evening of Friday, the thirteenth, we espied the lights from the "great white way" and we were anchored at quarantine within the "three mile limit."

18. HOME AGAIN

For the third time we had made the voyage. For the third time we had been fascinated by a wonderful people of Latin America. As on previous visits we vowed that we had become neighbors, and that we would repeat our visit again and again.

II. Supplementary Foreword

By EDWARD I. SALISBURY, M.D., Denver, Colorado

1. DEPARTURE OF WEST-COASTERS

AT eight-thirty o'clock on the morning of March 21 the shrill whistle of the "Internacional" echoed through Retiro Station of the Buenos Aires and Pacific Railroad. It shrieked a warning that fifty West-Coasters were leaving the cruise party of the *S. S. Vandyck* to enjoy thrills not to be had by the remaining cruisers who enviously followed the little group that morning to the station. There was a near panic among the West-Coasters as we scrambled for our cars lest we be left behind to retrace our steps on the *S. S. Vandyck* and miss a trans-continental tour and a cruise upon the South Seas.

The trip to Buenos Aires had been a glorious one—replete with joys and pleasures, filled with every luxury, and with pleasant associations of old friends and new. We were reluctant to say good-bye and have only memories for our tomorrows; but yet the call of the unexplored beckoned to us, and as we ran for the moving train we carried with us in our hearts a sorrow for those who were to be left behind and to be deprived of a most wonderful trip.

For some time I stood upon the platform as the "Internacional" rolled out of the train-shed, waving adieu to friends of the *Vandyck*. They stood there watching us depart, looking wistfully, longingly, wishing they had joined our party. And being a sympathetic creature I was moved and cast my eyes elsewhere that I might not view their dejection.

2. THE PAMPAS

Having recovered from the ordeal aforementioned, I took stock of the train, which was of the continental type. Our party was allotted two compartment cars and one diner.

Dr. Walter S. Stewart shared "*Camara* No. 4" with me, and after arranging our baggage and lighting our cigars, we settled comfortably into the cushions to take note of the terrain en route. We were now hurrying through the environs of Buenos Aires, with healthy signs of business and industry in the factories. The little houses or *casitas* of the outlying districts flew by;—we caught a glimpse of the Rio de la Plata in the distance, and soon were out upon the broad expanse of the Argentine pampas. As far as eye could see, like a restless ocean, stretched the waving green of the pampas grass, with here and there the hoary whiteness of its bloom appearing as white-caps in the surf. The far-scattered ranch-houses, with their ever-present windmills, dotted the horizon, and loomed like ships upon the deep. The illusion was constant, and one continually felt that he was riding along some coast-line, gazing seaward.

We came upon the great cattle-raising section and saw immense herds of fine cattle that were destined for the great markets of Buenos Aires, of Europe, and often the United States. Frequently we saw flocks of ostriches feeding in their awkward fashion in these great pastures. It was all so interesting, and as we drank in the unaccustomed view the porter informed us individually that *almuerzo* or luncheon was being served in the diner ahead. We entered and received a service of numerous courses, typical of the great hotels of South America. Leisurely we ate and viewed the passing scenes, the monotony of the pampas broken by lagoons and ponds alive with wild duck and geese; and occasionally large flocks of flamingos were seen standing knee-deep in the morass, like flaming sentries.

After a hearty luncheon, slowly consumed, came a welcome *siesta*, from which we were summoned to tea and cakes, or *Quilmes Crystal* and biscuits. A surprise awaited us without, for we were now entering the great agricultural belt. It was autumn, and a series of gasoline tractors were pulling great gang-plows, preparing for the sowing of the winter wheat. A few months earlier golden grain would have greeted us, and we might venture to suggest that oxen were used for plowing.

With like scenes, interspersed with pastures and grazing cattle, and now and then a *gaucho* or cowboy in full regalia riding out to his herds, we passed the hours until sunset and darkness came. Another meal was served, and afterward the diner became a social hall while the berths were being made up, in which we soon sought refuge as we were to arrive in Mendoza early the next morning to change to the Trans-Andean train.

3. THE ANDES

At six o'clock we were aroused and had just time enough to shave and have a cup of coffee before we arrived in Mendoza. In the early dawn, far to the westward, we could see the brown foothills of the Andes, and as the sun cleared the air,

the distant snow-caps became visible, with the volcanoes Tupungato and Aconcagua towering majestically over all. Spread out around us were the vast vineyards of Mendoza, the great wine-producing section of the Argentine.

At Mendoza we changed to our special narrow-gauge train for the trip across the Andes to Chile. Up to this time we had traveled six hundred miles as straight as the crow flies, and had reached an altitude of nearly 2,500 feet. Breakfast was served aboard immediately, and we began our climb to the foot-hills. The track follows the course of the Mendoza River, whose waters supply the great irrigation system used in the vineyards.

We soon found ourselves traveling over a great moraine, the remnant of glaciers of ages past. All vegetation, except a few scrub bushes and cacti, disappeared, and our laboring engine told us that our climb of the Andes had begun. In a few hours we were conquering the bleak mountain barriers, and we lunched while our train struggled up a rack (cog) road at an elevation of seven thousand feet. On every side giant mountains rose to stupendous heights—desolate but majestic, eager in their solitude to echo the noise of the engine that alone disturbs the quiet. For centuries only the halloo of the muleteer, wending his way over Cumbre Pass, broke the stillness that reigned supreme; but a decade or two ago the ring of iron and steel, and the hissing of steam resounded through mountain and vale, proclaiming man's triumph over a wilderness.

Occasionally we caught glimpses of snowcapped peaks, and fifty miles up the Tupungato Valley we saw the extinct volcano of the same name with its majestic peak raised some 22,000 feet heavenward. We passed *Los Penitentes* (The Penitents), a mass of volcanic pinnacled rock carved by nature and time to resemble a procession of cowled monks marching toward cathedral-like spires.

The air was chill as we left the train at Puente del Inca to view the great natural bridge of the Andes which spans the Cuevas River. The hotel near the sulphur springs is the starting point for excursionists to the monument of Chilean-Argentinian peace, "Christ of the Andes." The statue is not visible from the railroad which passes at a level of some 2,500 feet below.

Toward evening we entered the two-mile tunnel through the International and Continental Divide two miles above sea level, or, to be exact, 10,400 feet, and emerged on the Chilean side. Here we met the headwaters of the Aconcagua and Juncal rivers that flow Pacificward to irrigate the vineyards of Chile. The route is now through the Chilean Andes, but darkness overtook us and we had to forego the pleasure of seeing the *Salto* (Soldier's Leap). As our train was late, we dined aboard instead of in Los Andes. At this stop we changed to the broad-gauge Chilean State Railway, and were whisked off to the capital, Santiago. We reached our hotel and deserved rest at 2:00 A.M., after forty hours of travel.

4. SANTIAGO, CHILE

At Los Andes we were met by Dr. Edwyn P. Reed of Valparaiso, the Secretary of our Committee on Credentials. He accompanied us to Santiago and informed us of the program they had prepared for us. The following morning we were received in Del Salvador Hospital by the Fellows of the College in Santiago, including Dr. Reed and Dr. Muennich of Valparaiso, members of the Faculty of Medicine, and students. At a meeting in the amphitheater of the hospital, Dr. Hugh H. Young presented Dr. Gregorio Amunátegui, surgeon, dean of the Medical Faculty of the University, and recently elected president of the University, for Honorary Fellowship in the American College of Surgeons. This honor of the College was conferred by Dr. Truman W. Brophy, our acting president for the West Coast meetings.

Dr. Amunátegui was greatly moved by the honor, and accepted enthusiastically the *Toga Collegii*, expressing his gratitude and declaring himself an humble disciple among the ranks to hold sacred the ideals of the American College of Surgeons.

The remainder of the morning was consumed by sightseeing and visits to the institutions and hospitals in company with the Chilean Fellows and members of the profession, prominent among them Dr. Lucas Sierra, Dr. Luis Vargas, Dr. Caupolican Pardo Correa, Dr. Francisco Navarro Valenzuela, and others. At noon we enjoyed their hospitality at the Union Club, and in the afternoon we were received by the United States Ambassador, Honorable William Miller Collier, at the Embassy, a beautiful edifice and one of the few owned by the United States, of which we should be justly proud.

At four o'clock we were received in the Government Palace by the president of the Republic, Dr. Arturo Alessandri, who has just written the new health code for the country.

Santiago was in gala attire for the opening of the Fifth Pan-American Congress, recently in session. It is a city beautifully located upon many hills, and in little vales with attractive buildings and wonderful parks. I regret that our

time in this city was so short and that we could not remain longer in the company of its surgeons.

5. VALPARAISO, CHILE

On the morrow we entrained for Valparaiso, the great port of Chile, where we arrived at noon. The city is so named from the Valley of the Paradise, the fertile vale through which we passed en route from Santiago. Valparaiso is builded in the form of an amphitheater with the busy harbor as the stage. Three streets parallel to the shore line form the main business section of the city, while the residential section extends up the hillsides and out along the beach to Miramar and Viña del Mar.

Dr. and Señora Guillermo E. Muennich gave a beautiful garden party and tea for us at their home on Cerro Alegre (Happy Hill). They have a wonderful home and gardens overlooking the city and sea, and here we met many of our Fellows and their families, including Dr. Edwyn P. Reed, Dr. Alberto Adriasola, Dr. Rudecindo de la Fuente, Dr. Gaston Lachaise, Dr. Jean H. Thierry, Dr. Miguel Manriquez, and others. A visit to the hospitals of Valparaiso impressed us with their complete conception of a modern hospital. The Committee on Credentials for Chile presented the names of fourteen surgeons as candidates for Fellowship, and expressed themselves as determined to work for higher standards in their hospitals.

Dr. Reed, with four of his fine family of eight sons, accompanied us aboard our ship, the *S. S. Essequibo*, which sailed at noon on Sunday, March 25, northbound for the equatorial waters of the Pacific.

6. THE WEST COAST

We made several interesting stops along the barren coast of Chile—Antofogasta, Mejillones, and Arica, where we inspected the hospitals. At Arica we took a train across the desert to the city of Tacna, a small oasis. Here in the heart of the desert is a garden spot that is being extended by an irrigation system that will some day make it a great farming center. It was a memorable day. After a long trip across the hot sands, to find oneself in a beautiful vineyard and orchard, feasting upon delicious white, blue, and red grapes, peaches and figs from vine and tree, direct from producer to consumer, seemed a marvel indeed; and all this through the courtesy of Mr. Clarence Elliot, the British Consul and manager of the railroad.

After luncheon at the Raiteri Hotel and a visit about the city, we returned to Arica and our ship. The next day was spent at Mollendo, Peru, where cargo was taken aboard. The most striking thing of the ports are the myriads of guano birds that circle about in flight, almost in dense cloud formation.

7. LIMA, PERU

On Monday, April 2, we arrived in Callao, Peru, the port for the capital, Lima. Dr. Juvenal Denegri, Dr. Miguel Aljovin, Dr. Ricardo Palma, and Dr. Alejandro Bussalleu welcomed us at the port and accompanied us to Lima. We had but a few short hours to stay in that wonderful city; but we were able to see most of the interesting sights and visit the hospitals, University, and Medical School.

The Surgical Society of Peru, Dr. Miguel Aljovin, the president, presiding, entertained us at luncheon in the National Club, at which the wives of a number of local surgeons were present. Dr. Aljovin welcomed us in the name of the Surgical Society, eulogizing the surgeons of North America, their contributions to science, and the admirable organization of northern universities. Dr. Francisco Graña translated the address, and Dr. Truman W. Brophy responded, following which Dr. William F. Grinstead toasted the surgeons of Peru as representing the culture of the South. At a meeting of the Credentials Committee, four new candidates were presented, and Dr. Guillermo Gastañeta asked us to carry back the message that the Fellows of Lima were working to bring their hospitals up to the Minimum Standard.

One could spend several weeks in Lima, the City of Kings, visiting the Spanish-Colonial buildings and viewing their carved interiors. They are examples of the fine work of the artisans of those times, as are the paintings and tilings. The tiles were creations of both the old world and the new, but today the art is lost and cannot be duplicated even in Spain.

The new museum of San Marcos University, named for its founder, Señor Javier Prado, is carrying on studies and investigations destined to enlighten us on the history of the Incas and Tiahuanacos, and the aborigine tribes, the Chimus and Nascas, of which many monoliths remain.

We bade a hasty farewell to our friends of Lima and departed from their shores at sunset.

8. HOMEWARD BOUND

Our course was now set for the Panama Canal, and we arrived at the Balboa docks on the morning of April seventh. The party was divided, one group passing through the Great Gateway on the

steamer, and the other spending a few hours in Panama and going to Colon by rail.

Since our visit in February much interest has been aroused locally in the Gorgas Memorial Institute of Tropical and Preventive Medicine. The Chamber of Commerce and Rotary Club have nominated a committee to represent Panama in raising an endowment for this institution. A similar plan is to be carried out in every country, state and province where the name of William Crawford Gorgas, soldier and sanitarian, is revered.

We left Colon on the night of April 7, New York-bound via Havana. The time aboard ship was profitably spent in interesting medical meetings, reviews of the cruise, and exchange of impressions of the countries visited. Deck golf was the most popular sport. The "races" and a "bull fight" afforded great amusement.

A birthday dinner was tendered to Dr. Truman W. Brophy, the admirable chieftain of the West Coast party, whom we had learned to revere and love during our happy days of association.

9. DISEMBARKATION

The good ship *Essequibo* reached New York on Sunday afternoon, April 15, its mettle having been tested by thirty hours of severe storm just at the end of our voyage. We were still feeling sorry for our friends who had returned on the *S. S. Vandyck;* but we found that our sympathies were wasted, for those who met us on the dock reported a glorious return voyage, and they had been losing sleep fearing that we were unhappy on a strange ship!

The memory of the friends we made, their kindnesses, the associations, and the good fellowship will outlast time.

There is in each life some time or spot,
  Some hour or moment of night or day,
That never grows dim and is never forgot,
  Like an unfaded leaf in a dead bouquet;
Some rare season, however brief,
  That stands forever and aye the same;
A sweet, bright picture in bas-relief,
  Hanging before us in Memory's frame.

MINNESOTA, KENTUCKY AND TENNESSEE, AND VIRGINIA AND WEST VIRGINIA SECTIONAL MEETINGS OF THE CLINICAL CONGRESS

MINNESOTA

THE Minnesota sectional meeting of the Clinical Congress of American College of Surgeons for 1923 was held in Minneapolis on April 16 and 17 in conjunction with the clinic week of the Hennepin County Medical Society. The local arrangements were in the hands of a committee of Fellows of the College composed of Dr. Arthur T. Mann, chairman, Dr. R. E. Farr, and Dr. J. M. Hayes, and assisted by Mr. Roy Nelson. Good advance publicity was given both hospital and public meetings. Headquarters was at the Radisson Hotel where the hospital meeting was held in the Gold Room. This meeting drew a large attendance and the program brought out for discussion many interesting points relative to hospital work. At the meeting of the Fellows following the round table conference, the work of the College was reviewed and the State Committee for the ensuing year elected. The public meeting was held in the Methodist Church and was well attended. The Lieutenant Governor of the State, in a short and interesting address, welcomed the Fellows of the American College of Surgeons to Minneapolis. Besides the College officials, Drs. William Cubbins and Harry Richter of Chicago, Dr. J. E. Rush of the American Society for the Control of Cancer, New York, and the Rev. C. B. Moulinier of Milwaukee, president of the Catholic Hospital Association, took part in this program. The scientific section was in charge of the Hennepin County Medical Society. The state chairman, Dr. Thomas McDavitt of St. Paul, presided at the meetings.

KENTUCKY AND TENNESSEE

ON April 19 and 20, the Kentucky and Tennessee sectional meeting of the Clinical Congress of the American College of Surgeons was held at Lexington with headquarters and registration rooms at the Lafayette Hotel where both the hospital and scientific meetings were conducted. The public meeting was held in the Christian Church and drew a large and interested audience. The local Fellows of the College, headed by Dr. Charles Vance as chairman, composed the committee on arrangements. They were efficiently assisted by Mr. J. Dunn as publicity manager. To the energetic efforts of Dr. Vance and the local Fellows the success of these meetings is due. Clinics were held at the local hospital and were well arranged and carried out. Dr. David Barrow, state chairman for Kentucky, presided at the hospital and scientific meetings. Dr. J. A. Stucky, of Lexington, presided at the public session. There was a good representation of Fellows present from both states. Besides College representatives and Fellows of the College from both states, the hospital and public programs were presented by Dr. George Crile of Cleveland, Dr. Harry Mock of Chicago, Dr. Thomas L. Gilmer of Chicago, Rev. C. B. Moulinier, president of the Catholic Hospital Association, Milwaukee, Dr. J. A. Dieckman of Cincinnati, representing the Protestant Hospital Association, Mr. Robert Jolly of Houston, Texas, Dr. J. Garland Sherrill, University of Louisville, Dr. E. Dunbar Newell of Chattanooga, and Dr. Richard A. Barr. The College was represented by Dr. Malcolm T. MacEachern, associate director for Canada and president-elect of the American Hospital Association, and Dr. Allan Craig of Chicago, associate director of the College. Every one pronounced the Lexington meetings a splendid success.

VIRGINIA AND WEST VIRGINIA

THE city of Norfolk, Virginia, was the location for the Virginia and West Virginia, 1923, sectional meeting of the Clinical Congress of the American College of Surgeons. The meetings and clinics were held on April 23 and 24. Local arrangements for these meetings were in the hands of a committee of Fellows of the College headed by Dr. J. L. Rawls, and Dr. Lomax Gwathmey, chairman of the Virginia state committee. Headquarters and registration were at the Monticello Hotel; here also the scientific and hospital sessions were held. The publicity work for these meetings was in the hands of Mr. Jenkins, of Norfolk, and was very efficiently carried out. The public meeting was one of the largest which the College has had; the Epworth Church was crowded to the doors with a very attentive audience. Besides the usual public program, Dr. Louis Mendoza, of Norfolk, delivered a most inspiring address on the relationship of surgery to the public. Drs. Crile, Mock, MacEachern, Dieckman, and Craig also took part in this program. Dr. Lomax Gwathmey, state chairman, presided at all meet-

ings. The clinics conducted at the local hospitals showed evidence of careful preparation and organization. Dr. Stuart McGuire and Dr. J. S. Horsley, of Richmond, took part in the hospital program. At the meeting of the Fellows of the College, the state committees for the ensuing year were elected and following a review of the work of the College, Dr. George Crile, of Cleveland, gave a brief but interesting résumé of the work of the various research committees. The scientific meeting held on the afternoon of the second day was full of interest for every one as the addresses and papers were short and to the point, permitting opportunity for free discussion.

REPORT OF THE DEPARTMENT OF LITERARY RESEARCH

THE Library and Department of Literary Research of the American College of Surgeons has met a steadily increasing demand for the preparation of bibliographies and abstracts of medical and surgical literature. Over one hundred requests have been received by the Department during the first four months of the year. The service has been quite evenly distributed over the country: twenty-one requests came from New York, Massachusetts, Pennsylvania, and other eastern states; twenty from the southern states; eighteen from the middle west; and twenty-nine from the western states. Eight requests came from Canada and one from Korea to add to the list of inquiries from more distant Fellows of the College.

The requests differ greatly in the type of work desired. In some instances a particular article or abstract of an article is wanted. In other cases a list of references is sent in by the surgeon with a request for abstracts of the articles. Sometimes an interesting case report is supplied, with the request for a review of the literature to obtain reports of similar cases. In still other instances the working up of a bibliography with abstracts and translations is desired to make as complete a report as possible on a subject worthy of comprehensive research.

With the increase in the number of requests for the service it becomes more than ever important that the inquiries be received far in advance of the need for the completed data. Emergency requests are frequently taken care of, but much more complete and better organized data can be furnished at a like cost where more time is allowed.

The package library of material already classified and ready to be mailed out on loan is also of increasing importance. By this means the time spent on any one request is materially shortened so that it has been possible to care for the increase in demand without increasing the staff of research workers.

In this connection the importance is again emphasized of continually adding to this loan material. If every Fellow of the College would supply the Department regularly with articles as soon as they are published as well as previously written articles not already on file, the value of the material classified under the various specialties would be greatly enhanced. The space for this collection in the College Library is being extended to take care of all such contributions. Two copies of all reprints are desired, one for the College file as a permanent record of the works of the Fellows, the other for the classified loan material.

In sending in requests for this service it is always of prime importance to limit the scope of the research work to your specific interest in the subject. The abstracts prepared by the Department are then far more useful and to the point than abstracts prepared for general publication. The Department is occasionally asked for *all* the literature on a subject upon which volumes have been written, when as a matter of fact a few of the important recent articles are all that would be read by the surgeon sending in the inquiry. Such an inquiry coupled with a request to have the material completed in one or two weeks does not contribute to a satisfactory result. You cannot give the Department too much information in your letter of inquiry. In what phases of the subject are you interested? For example, *etiology* of the fused kidney, *anatomy* and *pathology* of the cervix of the uterus, *end-results* of operations for chronic appendicitis, *diagnosis* of renal tuberculosis, *treatment* of cancer of the tongue (surgical treatment as compared with radium and roentgen-ray) or *all phases* of pancreatic calculi, including *history, etiology, pathology, symptomatology, diagnosis, differential diagnosis, treatment,* and *prognosis.* How many years are to be covered? Recent literature? Past five or ten years? Everything since the review of the literature made by "Jones in 1909"? (Include complete citations when at hand.) When complete information regarding the nature of the work desired is given, no time is lost in getting the research under way, and a satisfactory result is made possible.